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Assessment of Development and Production Potential of Federal Coal Leases. Volume 2 Working Papers. Part A. The Development Prospects for Federal Coal Leases in Colorado 1980-1991: Results of Colorado Coal Leasing Task Force

Dames and Moore, Denver, CO

Prepared for

Office of Technology Assessment, Washington, DC

Jun 84

U.S. Department of Commerce
National Technical Information Service

J952-94

59272-101

REPORT DOCUMENTATION PAGE	1. REPORT NO.	2.	3. Recipient's Accession No. PB85 138097
4. Title and Subtitle: An assessment of Development and Production Potential of Federal Coal Leases. Vol II - Working Papers, Part A: The Development Prospects for Federal Coal Leases in Colorado 1980-1990: Results of Colorado Coal Leasing Task Force			5. Report Date: June 1984 6.
7. Author(s)			8. Performing Organization Rept. No.
9. Performing Organization Name and Address: Office of Technology Assessment US Congress Washington, DC 20510			10. Project/Task/Work Unit No. 11. Contract(C) or Grant(G) No. (C) (G)
12. Sponsoring Organization Name and Address: Same as box 9.			13. Type of Report & Period Covered 14.

15. Supplementary Notes: See also main OTA Report AN ASSESSMENT OF DEVELOPMENT AND PRODUCTION POTENTIAL OF FEDERAL COAL LEASES

16. Abstract (Limit: 200 words)

These working papers contain papers for OTA to assist in preparation of the report AN ASSESSMENT OF DEVELOPMENT AND PRODUCTION POTENTIAL OF FEDERAL COAL LEASES. The contents include: the development prospects for federal coal leases in Colorado

D/S

17. Document Analysis a. Descriptors

Coal
Mining
Reclamation
Coal mines
coal mining
coal deposits

b. Identifiers/Open-Ended Terms

federal coal leases
federal coal development
federal land management
Colorado
Coal lease management
air quality
coal development
coal production
technology assessment
environmental impacts
energy development

c. COSATI Field/Group

18. Availability Statement:	19. Security Class (This Report)	21. No. of Pages
	20. Security Class (This Page)	22. Price

PB85-138097

An Assessment of

Development and Production Potential of Federal Coal Leases

Volume II—Working Papers

Part A: The Development Prospects for Federal Coal Leases in Colorado 1980-1991: Results of Colorado Coal Leasing Task Force

This is an OTA Working Paper that has neither been reviewed nor approved by the Technology Assessment Board

June 1984

CONGRESS OF THE UNITED STATES
Office of Technology Assessment
Washington, D.C. 20510

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An Assessment of

Development and Production Potential of Federal Coal Leases

Volume II—Working Papers

Part A: The Development Prospects for Federal Coal Leases in Colorado 1980-1991: Results of Colorado Coal Leasing Task Force

This report is an OTA Working Paper, which was used in the preparation of OTA's final assessment report. OTA makes these working papers available for the use of readers desiring a more detailed or technical discussion of an issue than can normally be accommodated in our final report. As an OTA working paper, this report has not been reviewed or approved by the Technology Assessment Board. The findings and conclusions expressed in the report are those of the authors and do not necessarily reflect the views of OTA, the coal leasing project advisory panel or the Technology Assessment Board.

June 1984

CONGRESS OF THE UNITED STATES
Office of Technology Assessment
Washington, D.C. 20510

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Preface

This volume contains papers written for OTA to assist in preparation of the report *An Assessment of Development and Production Potential of Federal Coal Leases*. OTA does not endorse these papers. In several instances, the OTA report reaches somewhat different conclusions because of additional information which was obtained later. These papers, however, may prove valuable for readers needing more detailed or specific information that could be accommodated in the final assessment report, and are being made available for such purposes.

OTA WORKING PAPER A

PART I

THE DEVELOPMENT PROSPECTS FOR FEDERAL COAL LEASES IN COLORADO 1980-1991

RESULTS OF COLORADO COAL LEASING TASK FORCE

JANUARY 1982

CONGRESS OF THE UNITED STATES
OFFICE OF TECHNOLOGY ASSESSMENT
MATERIALS PROGRAM
WASHINGTON, D. C. 20510

Karen L. Larsen
Associate Project Director

Martin E. Zeller
OTA Consultant

Iris Goodman
Project Research Assistant

Patricia A. Canavan
Support Staff

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FOREWORD

This report summarizes the results of OTA's Coal Leasing Task Forces held in Denver, Colorado, in September, 1980, and OTA's assessment of the development prospects for federal coal leases in Colorado. The report is one of several state task force reports that were prepared as part of OTA's evaluation of existing federal coal leases and preference right lease applications requested under Section 10 of the Federal Coal Leasing Amendments Act of 1976, Public Law 94-377. OTA's final report, An Assessment of Development and Production Potential of Federal Coal Leases, was published in December 1981.

As part of the evaluation process, all undeveloped federal leases were rated according to their overall prospects for development in the next decade --favorable, unfavorable, or uncertain. The ratings were based on the amount and quality of the reserves under leases, the engineering, environmental, legal, and transportation considerations affecting development, and potential markets. The task force ratings were used with additional technical and economic analyses to estimate the potential production from existing leases in Colorado and to identify the major factors that will influence coal development in the state.

Information for this report was drawn from a variety of sources including an analysis "Market Factors and Production Contingencies Determining the Present and Future Demand for Colorado Coal" prepared by Joan Martin and Fred C. Hart Associates for the Colorado Energy Research Institute reprinted as Part II of this report. A paper on the issues and uncertainties affecting Colorado coal development prepared by Martin Zeller of the Tosco Foundation for OTA. Dr. C. Wayne Cook, Professor Emeritus, Colorado State University and

member of the OTA project advisory panel, provided material on reclamation conditions in Colorado. Technical materials for the Colorado task force were prepared by Dr. Frank J. Wobber and J. Stephen Scheindler of OTA and by D. Keith Murray and Stanley Sutton of the Colorado School of Mines Research Institute.

The information and conclusions in this report were reviewed by the task force participants, the OTA coal leasing project advisory panel, and a limited number of outside reviewers. In some instances, the OTA final report, An Assessment of Development and Production Potential of Federal Coal Leases differs from this report in the classification of some leases as undeveloped and on the amount of coal that might be produced from these leases. These differences are the result of information received after completion of the final task force report in December 1980 and do not significantly alter any of the conclusions in this report.

COLORADO

CHAPTER 1

EXECUTIVE SUMMARY

This report was prepared as part of the OTA coal leasing study mandated by Section 10 of the Federal Coal Leasing Amendments Act of 1976, Public Law 94-377, which requires OTA to make an independent evaluation of the development potential of the more than 500 existing federal coal leases. In September 1980, OTA convened a task force in Denver to assess the development prospects for 69 non-producing federal coal leases and to identify the major coal development issues in Colorado. This report presents the task force conclusions, the results of OTA's lease analysis, and summarizes the issues affecting development of federal leases in Colorado.

Federal Coal Leases in Colorado

The 127 federal coal leases in Colorado cover 126,893 acres and contain an estimated 2.2 billion tons of recoverable coal reserves. About 700 million tons of these reserves are surface mineable, the rest are recoverable by underground mining. In addition to the leases, there are 37 preference right lease applications (PRLA's) encompassing 82,923 acres and more than a billion tons of reserves that are pending approval in Colorado.

As of September 30, 1980, 54 leases were included in approved mining plans; 2 more leases were covered by proposed mine plans under review by the Office of Surface Mining; and the remaining 52 leases had no mine plans on file. In 1979, 24 federal leases were actively being mined with total reported production of 7.9 million tons or about 44 percent of the annual

state production.

Undeveloped Federal Leases

In its analysis, OTA divided federal leases into two categories--developed and undeveloped leases. Developed leases include all leases that were part of operating mines or had substantially complete mine plans under review for OSM permit approval. All other leases were classified as undeveloped. The mine plans for developed leases were analyzed by OTA's technical consultants.* Most of these mine plans provided the necessary information to assess the development and production plans of the lessees. However, for the undeveloped leases, it was necessary for OTA to assemble the information required to determine whether the lease could be developed and how much coal could be produced. The state task forces provided additional valuable information and insights to supplement OTA's analysis of the undeveloped leases.

Based on a review of the mine plan status of existing leases conducted in July 1980--over half of the federal leases in Colorado, 69 were classified as undeveloped. These 69 leases cover 77,734 acres or 62% of the total leased acreage in Colorado. They contain an estimated 1.475 billion tons of recoverable reserves, approximately 67 percent of the recoverable federal reserves under lease.

*The mine plan review for Colorado is contained in Dames and Moore, Analysis of Federal Coal Leases in Mine Plans in Colorado, New Mexico, and Utah, Final draft report, December 1980.

Evaluation of Undeveloped Leases

OTA's analysis of undeveloped leases approximates the approach a prudent developer might follow in identifying a favorable new mine property. First, the developer determines whether the tract has a sufficient quantity of mineable and marketable reserves to support a new mine. If so, then other conditions influencing the development potential of the tract are considered, such as the adequacy of existing transportation, possible adverse environmental impacts, and availability of community services. If no major obstacles or uncertainties are identified, the property then merits a more exhaustive examination of its potential profitability.

The 69 undeveloped federal coal leases in Colorado were divided into 45 lease blocks for analysis. (A lease block consists of all leases held by a lessee that are contiguous or are sufficiently close to form a compact mineable unit.) These blocks are shown in Table 1-1. One single lease block was dropped from future review because BLM was processing the lessee's request to relinquish the lease.

The lease blocks were reviewed by using a set of initial screens or threshhold criteria that are based on the coal reserves and financial requirements for a typical new Colorado surface or underground mine over the next decade. These screens are shown in Table 1-2. Of the 44 undeveloped lease blocks, 11 blocks containing a total of 28 leases met all of the threshhold criteria. Thirty-three blocks containing a total of 40 leases did not pass the initial screening. Of these 33 blocks that did not meet the characteristics for a viable new mine, 26 lease blocks failed solely because of insufficient reserves. However, seven of these blocks could support small mining operations as an alternative development possibility.

TABLE 1-1

OTA
COLORADO UNDEVELOPED LEASE BLOCKS
September 30, 1980

Block Number	Lessee	Number of Leases	Acres	County
1	AMCA Coal Leasing	1	250.41	Routt
2	Franklin Real Estate	1	634.42	Routt
3	Fern James, Estate	1	40.10	Moffat
4*	Prosper Lombardi	1	80.00	Routt
5	W.R. Grace & Company	1	3863.00	Moffat
6	Peabody Coal Company	1	1320.00	Routt
7	Peabody Coal Company	1	160.00	Routt
8	Peabody Coal Company	1	2280.00	Routt
9	Ruby Construction Company	1	146.26	Routt
10	Sheridan Enterprise	1	160.00	Routt
11	Utah International	1	159.55	Moffat
12	Consolidation Coal Company	2	4578.69	Rio Blanco
13	Consolidation Coal Company	1	225.86	Rio Blanco
14	Consolidation Coal Company	1	1096.73	Rio Blanco
15	Consoldation Coal Company	2	1331.50	Rio Blanco
16	Utah International	1	2255.22	Moffat
17*	Western Fuels Association	1	2557.22	Rio Blanco
18*	Western Fuels Association	1	513.00	Rio Blanco
19	Russell Chapman & Paul Riebold	1	1675.22	Rio Blanco
20	Gulf Oil Company	1	280.00	Delta
21*	ARCO	3	7419.61	Gunnison
22*	Anchor Coal Company	1	280.00	Gunnison
23	U.S. Steel Corporation	1	1092.33	Gunnison
24	U.S. Steel Corporation	1	560.00	Gunnison
25	U.S. Steel Corporation	1	213.99	Gunnison
26	Thompson Creek Coal	1	120.00	Gunnison
27**	Garland Coal	1	497.64	Pitkin
28	U.S. Steel Corporation	8	3469.13	Gunnison
29*	Anschutz Corporation	2	4881.95	Pitkin
30	AMCA Coal Leasing	1	120.00	Jackson
31 A,B	Kemmerer Coal & Consolidation	1	560.00	Jackson
31 C	Kemmerer Coal & Consolidation	1	1680.00	Jackson
31 D	Kemmerer Coal & Consolidation	1	1706.92	Jackson
32	Wyoming Fuels	1	172.75	Jackson
33	Welch & Wiggins	1	120.25	Garfield
34*	Sheridan Enterprises	6	14,929.33	Garfield
35*	Belden Enterprises	1	41.29	Delta
36	Utah International	1	173.70	Delta
37*	Harry & Opal Weaver	1	80.00	Gunnison
38 A	Kemmerer Coal Company	6	10,002.72	Gunnison/ Montrose
38 B	Kemmerer Coal Company	1	2320.00	Ouray
39	Albert Martinez	1	40.00	Las Animas
40	CF&I Steel Company	1	961.92	Las Animas
41	Peabody Coal Company	3	1923.68	Elbert
42	Peabody Coal Company	1	760.00	Elbert

*mine plan on file at U.S. Department of the Interior, Office of Surface Mining, as of September 30, 1980.

**relinquishment pending

TABLE 1-2

OTA SCREENING PROCESS FOR UNDEVELOPED FEDERAL COAL LEASES IN COLORADO

REVISED THRESHOLD CRITERIA FOR VIABLE NEW MINES

CASE 1 - LARGE SURFACE MINE

Large surface mine producing coal for electric utility use.

Mine size: 500,000 tons/year
Mine life: 30 years

Reserves: 15 million tons of surface recoverable reserves

Quality:

- o 10,000 BTU/lb. or more (for North Park Field only, BTU/lb of 9000 or more)
- o 0.7% sulfur or less
- o 12% ash or less

Seam Thickness: 6' or more

Overburden: 250 feet or less

Seam dip: over 15° presents difficulty, but Colorado surface mines operate on seams up to 60° dip

Initial Capital Investment: $5-$10 million

CASE 2 - LARGE UNDERGROUND MINE

Large underground mine producing coal for electric utility, metallurgical, or industrial use.

Mine size: 500,000 tons/year
Mine life: 30 years

Reserves: 15 million tons of underground recoverable reserves

Coal Quality:

- o at least 12,000 BTU/lb.
- o 0.7% sulfur or less (For Coal Basin field only 1.0% sulfur or less.)
- o 10% ash or less

Seam thickness: 6'

Overburden: 250 feet or more

Seam dip: over 8° is difficult, however Colorado underground mines operate in seams up to 30°

Initial Capital investment $25-$30 million

CASE 3 - SMALL MINE ALTERNATIVE

Small underground or surface mine producing coal for utility, spot market, industrial or local use.

Mine size: up to 50,000 tons/year
Mine life: 20 years

Reserves: 1 million tons of recoverable reserves

Coal Quality:

- o at least 10,000 BTU/lb.
- o 1.0% sulfur or less
- o 10% ash or less

Seam thickness: 3' or more

Overburden: to 100 feet for surface mines

Seam dip: Not a limiting factor for small mines.

Initial Capital Investment: $1-$2 million.

The screening results are shown in Table 1-3.

OTA Evaluation of Colorado Coal Market and Issues and Uncertainties Affecting Colorado Coal Development

As part of OTA's initial evaluation of the undeveloped federal leases in Colorado, two draft contractor reports were prepared on 1) market factors determining the future demand for Colorado coal* and 2) issues and uncertainties which more generally affect Colorado coal development. These two reports were prepared for use by the Colorado Task Force and OTA's own analysis. During the preparation of these reports, numerous discussions were held with representatives of government, industry and public interest groups in order to gain an understanding of the factors critical to determining the 5-10 year potential for Colorado coal. The reports were reviewed by the Colorado task force participants and were approved with slight modifications. Market projections were adopted as a conservative estimate of Colorado coal demand over the next decade which measure development potential of existing leases.

The Colorado market projections developed for the OTA task force were based on a survey and analysis of the production plans for all operating and proposed mines and existing contracts for Colorado coal. This "bottoms up" or mine specific approach yields a conservative yet realistic picture of likely production for the next ten years. This projection was reviewed by the Colorado task force and adopted with slight modifications as a minimum estimate of the future market for Colorado coal.

TABLE 1-3

SUMMARY OF ANALYSIS OF UNDEVELOPED FEDERAL COAL LEASES IN COLORADO - OCTOBER 1980

Block Number	Lessee	# of Leases	Acres	County	Type of Reserve	Passes All Screens	Task Force Classification	Task Force Evaluation of Development Prospects 1986	1991	OTA Final Evaluation
1	AMCA Coal Leasing	1	250.41	Routt	U&S	No	+	?	?	?
2	Franklin Real Estate (Grace)	1	634.42	Routt	U	No	-	-	?	-
3	Fern James, Est.	1	40.10	Moffat	U	No	-	-	-	-
4	Prosper Lombardi	1	80.00	Routt	U	No	-	-	-	-
5	W.R. Grace	1	3863.00	Moffat	U&S	Yes	+	-	?	?
6	Peabody Coal Company	1	1320.00	Routt	S	No	+	+	+	+
7	Peabody Coal Company	1	160.00	Routt	U	No	-	-	-	-
8	Peabody Coal Company	1	2280.00	Routt	U	No	+	-	+	+
9	Ruby Construction Co.	1	146.26	Routt	U&S	No*	+	-	?	?
10	Sheridan Enterprises	1	160.00	Routt	U	No	-	-	-	-
11	Utah International	1	159.55	Moffat	U	No	-	-	-	-
12	Consolidation Coal	2	4578.69	Rio Blanco	U&S	Yes	+	-	?	?
13	Consolidation Coal	1	225.86	Rio Blanco	U	No	+	-	?	?
14	Consolidation Coal	1	1096.73	Rio Blanco	U	Yes	+	-	?	?
15	Consolidation Coal	2	1331.50	Rio Blanco	U	Yes	+	-	?	?
16	Utah International	1	2255.22	Moffat	S	Yes	+	-	?	?
17	Western Fuels	1	2557.22	Rio Blanco	U	No	+	?	+	+
18	Western Fuels	1	513.00	Rio Blanco	U	No	+	?	+	+
19	Russell Chapman & Paul Riebold	1	1675.22	Rio Blanco	U	No	+	-	?	-
20	Gulf Oil Company	1	280.00	Delta	U	No*	-	-	-	-
21	ARCO	3	7419.61	Gunnison	U	Yes	+	+	+	+
22	Anchor Coal Company	1	280.00	Gunnison	U	Yes	+	+	+	+
23	U.S. Steel Corporation	1	1092.33	Gunnison	U&S	No	+	-	?	?
24	U.S. Steel Corporation	1	560.00	Gunnison	U&S	No	+	-	?	?
25	U.S. Steel Corporation	1	213.99	Gunnison	U	No	+	-	?	?
26	Thompson Creek Coal	1	120.00	Gunnison	U	No*	-	-	-	-
27	Garland Coal	1	497.64	Pitkin	Relinquishing Lease					
28	U.S. Steel Corporation	8	3469.13	Gunnison	U	Yes	+	-	+	+
29	Anschutz Corporation	2	4881.95	Pitkin	U	Yes	+	?	+	+
30	AMCA Coal Leasing	1	120.00	Jackson	U&S	No	-	-	-	-
31A&B	Kemmerer Coal/Consol	1	560.00	Jackson	U&S	No	+	-	?	?
31C	Kemmerer Coal/Consol	1	1680.00	Jackson	U&S	No	+	-	?	?
31D	Kemmerer Coal/Consol	1	1706.92	Jackson	U&S	Yes	+	-	?	?

SUMMARY OF ANALYSIS OF UNDEVELOPED FEDERAL COAL LEASES IN COLORADO - OCTOBER 1980

Block Number	Lessee	# of Leases	Acres	County	Type of Reserve	Passes All Screens	Task Force Classification	Task Force Evaluation of Development Prospects 1986	1991	OTA Final Evaluation
32	Wyoming Fuels	1	172.75	Jackson	U	No*	-	-	-	-
33	Welch & Wiggins	1	120.25	Garfield	U	No	-	-	-	-
34	Sheridan Enterprises	6	14929.33	Garfield	U	Yes	+	?	+	+
35	Belden Enterprises	1	41.29	Delta	U	No*	+	+	+	+
36	Utah International	1	173.70	Delta	U	No*	-	-	-	-
37	Weaver	1	80.00	Gunnison	U	No	+	+	-	+
38A	Kemmerer Coal	6	10,002.72	Gunnison/ Montrose	U	No	+	-	-	-
38B	Kemmerer Coal	1	2320.00	Ouray	U	No	+	-	-	-
39	Martinez	1	40.00	Las Animas	U	No	-	-	-	-
40	CF&I Steel Co.	1	961.92	Las Animas	U	No	+	-	-	-
41	Peabody Coal Co.	3	1923.68	Elbert	S	No	+	-	?	?
42	Peabody Coal Co.	1	760.00	Elbert	S	No	+	-	?	?

*Passes small mine screen.

Although coal production in Colorado has increased at an average annual rate of over 20% for each of the last five years, this trend is not expected to continue. Based on the study prepared for OTA, it is expected that the demand for Colorado coal will grow at a comparatively modest level of only five to seven percent annually over the next decade. It is likely that there will not be enough demand to absorb all the potential production from existing mines, proposed mines, undeveloped federal leases, new federal lease sales, and PRLAs. Colorado mines currently have a total annual production capacity of 37 million tons. As new mines are opened over the next decade, the amount of overcapacity will continue to increase.

The OTA Colorado Market Study estimated that annual Colorado coal production will grow from 18.1 million tons in 1979 to 24.6 to 25.9 million tons in 1986, and to 26.0 to 34.8 million tons in 1991. Most of the coal will be used by electric utilities. Industrial and domestic use will remain stable at or near 1979 levels. No synthetic fuels plants using Colorado coal will be in commercial operation by 1991.

The market projections assumed that Colorado coal will continue to face substantial competition in existing markets in the West, mid-west and south. Foreign exports are not expected to be a significant portion of Colorado production until after 1991. Because of the long lead times required to open a new mine (from six to eight years from lease acquisition according to industry sources), a mine must have been proposed by 1980 to be in production by 1986. Production from existing undeveloped federal leases is possible by 1991, however, production from new federal leases and PRLA's is not expected by 1991, except for expansions of existing operations. No Colorado tracts are expected to be offered in the new federal lease sales

for the Uinta Region in 1981 or the San Juan Region in 1983.

These factors influencing coal development in Colorado which surfaced with the greatest frequency in the surveys conducted for the market and issues studies were considerations relating to market, transportation, and governmental, primarily federal, policy.

Market

In 1979, 71.5% of Colorado's coal production was consumed by electric utilities in Colorado and out-of-state. Despite the generally high grade of Colorado steam coal, its use in Eastern and Southern markets is not expected to grow as dramatically in the next decade because of competition from cheaper Wyoming and Montana coals, high rail transportation costs, a greatly decreased rate of growth of electricity demand with resulting delays in power plant construction and the slow rate of conversion from oil and gas to coal. Much of Colorado's coal will continue to be sold on the spot market and as blending coal due to its high quality. A number of the largest surface mines are nearing depletion of their reserves and more costly underground production will surpass surface production once again between 1986 and 1991. In 1980, the coal market was so soft that several mines were stockpiling coal at unprecedented rates and numerous mines either laid off workers or cut back on production. Other major market uncertainties affecting future demand for Colorado are summarized below.

o Coal Synthetics: While there is a great deal of speculation about the development of possible coal synthetic fuels plants in Colorado, only one proposed by W.R. Grace has actually reached the feasibility study stage. Given the long lead time (up to ten years) required, it is unlikely that this or other commercial scale synfuels plants using Colorado coal will be operating before 1990.

o Export Market: Despite the fact that several Colorado coal companies have sent coal to Japan for sample burns and the Japanese have shown interest in high quality Colorado coal as a means to diversify their supply, it is unlikely that the export market for Colorado coal will be significant in 1991

(i.e., more than about 5% of total production at most). The major impediments to a large foreign use of Colorado coal are high rail costs, foreign competition, competition from Utah and New Mexico and the fact that West Coast ports will require major upgrading to increase export capacity.*

o Future Metallurgical Coal Market: Most of the metallurgical coal produced in Colorado supplies either the CF&I plant in Pueblo, U.S. Steel's Geneva Plant in Orem, Utah, or Kaiser's California plant. Air and water quality problems at the Geneva plant had threatened production at U.S. Steel's Somerset Mine. However, EPA and U.S. Steel have recently announced an agreement resolving the compliance problems. The continued stability of Colorado's metallurgical coal market remains uncertain because of the problems in the steel industry stemming from increased foreign competition, the costs of meeting environmental regulations and national economic conditions.

o Industrial Coal Demand: Industrial and commercial use of Colorado coal has grown from 18 to 26% of Colorado's production from 1977 to 1979. Industrial coal consumption may continue to increase in the near future.

Transportation

Many of the operators in the Green River Region, which produces two-thirds of Colorado's coal production, complain that rapidly escalating rail rates are destroying their competitiveness with other producing states. The Denver and Rio Grande Western Railroad responds that the rates are fair and reflect the high costs of upkeep on difficult sections such as the Moffat Tunnel, new railroad sidings to increase capacity, and the installation of

*During 1981, several West Coast ports announced projects for needed expansions of coal loading and storage facilities to serve expanded exports, thus removing, in part, one constraint to increase exports.

automated traffic handling systems. Oth r transportation issues relate to the following:

o Capacity: The capacity of the DNRG to move major increases in coal production from northwestern and west central Colorado is subject to question given proposed new leasing. The Green River-Hams Fork EIS states that the DRNG will be at 86% of capacity under the preferred leasing alternatives. Coal slurry pipelines are not currently a viable transportation alternative due to the Colorado Legislature's ban on the exportation of water.

o Rail Access: Areas which are either unserved (San Juan region) or poorly served by rail transportation (Danforth Hills, North Park) are not likely to be developed to their full potential until major rail investments are made.

o Grade Crossings and Separations: The problem of adequate grade crossings and separations is one faced daily by communities throughout Colorado. Although major rerouting and grade separations have been proposed, little remedial action has occurred and the combined effect of Colorado and Wyoming unit train coal traffic has caused accidents and long waiting lines at crossings.

Government Policy

Government policies and regulations such as coal conversion requirements, synfuels incentives, air and water quality standards, nuclear, conservation, and alternative energy programs, and federal land management policies can have a profound impact on coal development, both positive and negative. At present, the situation is ambiguous as to whether the combined effect of these actions and currently unresolved issues on markets for Colorado coal will be

stimulative or depressive in nature. The following governmental programs will have the greatest impact on Colorado coal development:

o Federal Coal Management Policies: Several actions relating to federal coal management will affect the development potential of existing leases. The first lease sale under the new coal management program will occur in the Green River-Hams Fork region in January 1981. Seven Colorado tracts which the BLM estimates to have 7.4 million tons of new annual capacity will be offered. These new leases will compete with existing undeveloped leases for potential new markets.

The enforcement of the Department of Interior's 1976 diligence regulations could have several effects on the development potential of existing leases in Colorado. Some leases would be subject to cancellation for failure to satisfy diligent production requirements. Cancellation would thus remove them from competition with remaining leases; some mines would seek extensions and, if granted, would remain among the potential competitors for a share of future markets. Other mines might be prompted to begin production earlier and at a higher level than otherwise in order to satisfy production requirements. The coal would then be stockpiled or sold on the spot market. Still other lessees would negotiate with USGS to include undeveloped leases in existing mining units or reduce their holdings so that their actual production would meet diligence, thus retaining some leased coal that might otherwise be lost.

The processing and disposition of the 37 pending PRLAs, many of which are adjacent to existing or proposed new mines, would significantly increase the total amount of leased federal reserves in the State. The PRLAs are expected to be issued by 1984. Several Colorado PRLAs are, however, involved in

litigation over the requirements for approval of a PRLA, and resolution of these disputes could be delayed beyond 1984. Production from these PRLAs will compete with existing and new federal leases for future markets.

o Water Quality and Availability: The availability of water is one of the chief factors limiting energy-related development in Colorado. Water requirements for coal mines are relatively small in comparison to requirements for synthetic fuels plants and coal-fired generating stations. The principal shortage in Colorado is in water storage capacity. Many of the major energy development proposals include construction of new reservoirs.

Some coal companies acquire senior water rights owned by agricultural interests, and lease the water back to them until it is needed for development. There may be a long-term decline in agriculture as a result of this practice, especially as competition for scarce water supplies increases as energy industries become established and front range communities grow.

o Air Quality Standards: The cumulative impact of new coal-fired generating plants, synthetic fuels plants and secondary population growth in heavily developed areas may exceed clean air standards and could inhibit new growth. The impacts on lease development are expected to be indirect since mines are not a major source of air pollution. Rather, the construction of powerplants and synfuels or industrial facilities using coal could be limited thus reducing possible demand for coal. There are three wilderness areas within a sixty-mile radius of Craig which may impose conditions on new energy development which may be required to preserve their Class I air quality designations. New visibility standards and New Source Performance Standards which may be promulgated for synfuel technologies could affect potential coal-derived synthetic fuel development.

o Reclamation: Since most of the projected new mine development is expected to occur in underground mines, reclamation problems are not expected to be severe. However, some underground mining areas in the Uinta coal region such as the Carbondale and Somerset coal fields are likely to pose difficult reclamation conditions due to their climate and topography.

The major disturbances associated with underground mining are construction of sedimentation ponds, access roads, and mine facilities, and subsequent surface subsidence, possible diversion of surface water and interception of groundwater supplies.

Socioeconomic Impacts

The potential for major socioeconomic dislocations associated with the combined affect of coal and other types of energy development is evident in Craig, Meeker, North Fork communities, and other areas of Colorado. The cumulative effects of oil shale, coal, uranium, and reservoir development around Meeker could potentially lead to a quadrupling of population in several years. In Craig, development of new leases within 25 miles of town, construction of two new units at Craig station, construction of synfuels plants, and regional reservoir development in the next ten years could produce a major influx in population. North Fork communities face the prospect of populations doubling in the next few years if projected coal development occurs causing housing, traffic and infrastructure problems. If these communities are to meet their responsibilities in providing for projected increases in population they will either need a greater percentage of revenues generated by existing royalties and severance taxes, greater industry assistance, or federal assistance from proposed energy impact assistance legislation.

OTA Colorado Task Force

The OTA Colorado Task Force, composed of representatives from government, industry, and public interest groups, was convened to critically evaluate the development potential of the 44 undeveloped lease blocks and to assist OTA in identifying the major issues affecting coal development in Colorado. The task force participants were asked to review each lease block and to make several evaluations. First, they were asked to determine whether the lease block would support a viable mining operation; and secondly, to assess whether the block was likely to be in production by 1986 or 1991, given the expected market conditions of the next decade. The task force completed its evaluations by estimating the potential production from the lease blocks that were classified as favorable or uncertain prospects for development for the years 1986 and 1991, respectively. The results of the task force are presented in Chapter 3 of this report. Table 1-4 summarizes the task force classifications.

Task Force Classification of Lease Property Characteristics

The Colorado Task Force assessed each of the 44 lease blocks according to whether the block represented a favorable, unfavorable, or uncertain property for a potential new coal mine. In rating the property characteristics of each lease tract, the task force considered the amount and quality of reserves, geologic and topographic conditions, and potential conflicts with surface resources or uses. Each block was considered individually without any additional federal or non-federal reserves.

The task force identified 31 lease blocks, encompassing a total of 55 leases, as favorable new mine properties. Thirteen single lease blocks were

TABLE 1-4: SUMMARY OF TASK FORCE EVALUATIONS - UNDEVELOPED LEASE BLOCKS IN COLORADO

	Number of Blocks	Number of Leases	Acres	Recoverable Reserves (millions of tons)
Totals:	44	68	77,237	1,471
Property Characteristics				
Favorable Mine Properties	31	55	74,976	1,437
Unfavorable Mine Properties	13	13	2,261	33.7
1986 Development Prospects				
Favorable	5	7	9,141	220
Uncertain	5	11	23,132	208
Unfavorable	34	50	44,964	1,044
1991 Development Prospects				
Favorable	10	25	37,692	503
Uncertain	18	22	24,554	837
Unfavorable	16	21	14,991	131

identified as unfavorable new mine properties. The 31 favorable lease blocks cover approximately 74,976 acres and contain an estimated 1,437 million tons of recoverable reserves, or 59 percent and 66 percent of Colorado's federal coal lease acreage and recoverable reserves, respectively. In comparison, the unfavorable blocks contain about 34 million tons of recoverable reserves, or 1.5 percent of the state's recoverable federal coal reserves.

Task Force Evaluation of Development Potential of Undeveloped Leases

The task force was asked to evaluate the prospects for development in both 1986 and 1991 for each of the lease blocks. The task force found that the prospects for development by 1986 of existing federal leases without mine plans is generally unfavorable. This conclusion is consistent with the CERI market study which projects only moderate increases in Colorado coal production over the next decade. Only five lease blocks (seven leases) are considered favorable prospects for production in 1986. Of these, one is an expansion of an existing mine, another represents a major new mine to meet due diligence requirements, and the other three are small mining operations whose reserves are expected to be exhausted by 1990. These leases cover about 9,140 acres and are estimated to contain about 219 million tons of recoverable reserves (or 7.2 percent and 10 percent of total federal Colorado acreage and reserves, respectively).

Of the remaining lease blocks, the task force considered five (11 leases) with having uncertain development prospects, and 34 (50 leases) as having unfavorable prospects for 1986. The recoverable reserves in these categories are roughly 207 and 1,046 million tons, respectively.

The task force evaluation of 1991 prospects varied considerably from the lower bound of the market study projections of 1991 production levels. The task force generally was more optimistic with regard to the potential for small mine operations, the development of additional domestic markets for Colorado coal, the potential for export coal, synfuels, and prospects for greater industrial use of coal.

For 1991, the task force ranked 10 lease blocks (25 leases) as favorable. This represents roughly 503 million tons, or 23%, of the state's recoverable federal coal reserves under lease, which are found on approximately 37,691 acres of land. Of these, only one lease would be surface mined. One of the lease blocks would be an expansion of an existing mine, three are associated with new power plant construction, three will require new steam coal markets and three will require new metallurgical or steam coal markets. Only two of these lease blocks would likely be developed as small mines producing under 100,000 tons per year, several blocks would represent major expansions of existing small mines.

The task force found 18 lease blocks (22 leases) were in the uncertain development category for 1991. These blocks cover about 24,544 lease acres and contain an estimated 837 million tons of recoverable reserves--or almost 38 percent of the state's recoverable federal coal reserves under lease. Of these, nine are underground mineable, five strippable, and two have both surface and underground reserves. Several of these leases could support new small mines. Development of several others are contingent on additional reserves from new leases or from pending PRLA's before they can be developed.

The remaining 16 lease blocks (21 leases) were found to have

unfavorable development potential since they are unlikely to be producing by 1991. These blocks cover approximately 14,990 acres, and contain about 131 million tons of coal--about 6% of the state's recoverable federal coal reserves under lease.

Task Force Estimates of the Potential Production for Undeveloped Leases

The task force was asked to evaluate the potential total production from those leases that were rated as favorable or uncertain development prospects for 1986 and 1991. These production estimates are based on the same assumptions as the market projections adopted by the task force. The results of this evaluation yield the following production estimates for production potential of undeveloped leases in Colorado.

Classification	Potential Production (Million tons) 1986	1991
Favorable	0.76 - 1.81	11.25 - 12.25
Uncertain	0.05	3.05 - 60.5
Total	0.81 - 1.86	14.3 - 18.3

About 600,000 tons of the 1986 production would be strip mined, the rest would come from underground mines. Up to 5.6 million tons of 1991 production would come from new surface mines.

The initial Colorado market study projected total state production of 24.6 million tons in 1986 and 26.3 million tons in 1991 based on a survey of contracted and planned production from existing and proposed mines on federal and nonfederal land. When the potential new production from undeveloped federal leases is added to the market survey estimates of future production from existing and proposed mines, the favorable and uncertain

leases could contribute about 1.3 million tons of new annual production in 1986 and from 5.5 to 11.5 million tons in 1991. Production from undeveloped federal leases could increase Colorado production to a total of 25.9 million tons in 1986 and to 31.8 to 37.9 million tons in 1991. The total production figures were derived by comparing the task force estimates of lease block production potential and the survey projections and then eliminating any double-counting or inconsistencies. These totals are based on the assumption that all of the favorable and uncertain lease blocks find markets and are developed. The projections show the possible contribution of existing federal leases to Colorado coal production in the next decade.

The 1986 estimate falls within the CERI market study estimates and the expectations of the Task Force. Most of this new production would come from expansion of existing mines or opening of new mines to meet the diligence requirements and expected markets. The 1991 figures, however, are higher than those projected in CERI's initial market analysis. To some extent, the 1991 estimates reflect the greater uncertainties entailed in attempting a ten year projection. In addition, they reflect the Task Force's optimism that a number of viable mining properties and companies would find future markets for new production. The new markets could come in part from increased foreign exports, mine development to meet projected synthetic fuels requirements, and new domestic demand from industrial and utility users. Moreover, they reflect the optimism that several new small underground mines each producing less than 200,000 tons per year would be economically viable. Finally, they indicate that there may be significant underutilized production capacity in 1991 (i.e., 3-9 million tons per year).

When the OTA Colorado Coal Production estimates are compared with the

latest DOE production goals, they appear modest. According to DOE projections, 1985 Colorado coal production requirements range from 32.8 to 39.2 million tons with 36.3 million tons as the mid-level goal. DOE's 1990 production goals range from 38.4 to 45.2 million tons with 41.6 million tons as the mid-level goal. However, if DOE's 1990 production requirement for projected synthetic fuels needs (7.6 million tons) is subtracted from the mid-level range, a 1990 estimate of 34 million tons per year results. This figure is well within OTA's estimates for 1991 and reflects a significant difference in perception with regard to the development and timing of a coal-derived synthetic fuels industry in Colorado.

OTA Evaluation of the Development Potential of Existing Leases

After the task force, OTA reviewed the task force evaluations of the lease block property characteristics and prospects for development. This review was undertaken to meet OTA's responsibility for independent assessments and to assure that the Colorado task force classifications are comparable to those used in other state task forces. Based on this review, OTA changed the task force classifications of three lease blocks. Two changes were made to conform the final classifications to uniform standards. The other modification was made because of changes affecting the status of the lease block after the task force meeting. These changes did not affect potential production from existing lease blocks--production from two blocks was relatively small and production from the third, if developed, would not begin until after 1991 under the task force assumptions.

Based on this review, OTA adopted with minor modifications, the task force assessments of the development potential for federal leases. Eleven lease blocks were classified as favorable; 16 leases were classified as

TABLE 1-5: SUMMARY OF OTA'S FINAL EVALUATION OF UNDEVELOPED LEASE BLOCKS IN COLORADO

	Number of Blocks	Number of Leases	Acres	Recoverable Reserves (million tons)
Totals	44	68	77,237	1,471
Development Potential				
Favorable Development Potential	11	26	37,772	503
Uncertain Development Potential	16	20	22,244	816
Unfavorable Development Potential	17	22	17,221	151

uncertain and 17 blocks were rated as unfavorable. Table 1-5 summarizes OTA's modifications and final classifications of the undeveloped lease blocks.

The 11 favorable lease blocks have a total of 26 leases covering approximately 37,771 acres and contain an estimated 503 million tons of recoverable reserves. This represents approximately 34 percent of the currently undeveloped lease reserves and approximately 24 percent of total federal lease reserves in the state.

Sixteen uncertain lease blocks with a total of 20 leases cover a total of approximately 22,244 acres and an estimated 816 million tons of recoverable reserves. This represents approximately 55.5 percent of the undeveloped lease reserves, and approximately 37% of total federal lease reserves in Colorado.

The 17 unfavorable lease blocks with a total of 22 leases cover about 17,220 acres and contain approximately 151 million tons of recoverable reserves. These leases represent 10.3 percent of the undeveloped lease reserves and 6.9 percent of the federal lease reserves in Colorado.

Conclusions

The OTA Colorado Task Force reviewed 69 undeveloped federal coal leases in Colorado--over half the existing federal leases in the State. Of these 69 leases, 17 were included in incomplete or inactive mining plans on file with OSM, 51 had no mine plans, and one lease was being relinquished by the lessee. (The lease under relinquishment proceedings was not analyzed further.) The 68 remaining leases were divided into 44 lease blocks for analysis of their prospects for development. The 44 lease blocks cover a total of 77,236 acres and contain an estimated 1.47 billion tons of recoverable reserves. The undeveloped lease blocks represent 61% of the total federal acreage under lease in Colorado and contain 66% of the recoverable reserves under lease. Several tentative conclusions of potential significance emerge from the foregoing analysis of undeveloped federal leases in Colorado:

o Most of the currently undeveloped federal leases in Colorado have sufficient reserves of good quality, mineable coal to support viable mining operations. Twenty-eight leases (11 blocks) met OTA's minimum requirements for new mines. Seven more lease blocks met the minimum standards for new small mines.

o The task force rated 31 lease blocks (55 leases) as favorable mineable properties that could support mining operations either singly or in combination with additional lands controlled by the lessee.

o Development prospects for most undeveloped federal leases were unfavorable for 1986. Only 18 leases (10 lease blocks) were rated as likely to be in production by 1986. The rest of the leases (50 leases in 34

blocks), including several with recently proposed mine plans, were rated as unfavorable prospects for development by 1986.

o For 1991, the task force classified 28 lease blocks (47 leases) as favorable or uncertain development prospects including 20 blocks (30 leases) that were ranked as unfavorable in 1986. For about half of the undeveloped lease blocks, the applicability of diligent development requirements and possible eligibility for five year extensions become critical issues.

o The market for Colorado coal is expected to grow at a relatively moderate rate in the 1980s and into the 1990s compared to the accelerated expansion in the 1970's when total annual state coal production nearly tripled in 5 years (from 6.9 million tons in 1974 to 18.1 million tons in 1979. Potential new coal markets such as foreign exports, conversion from oil and gas, industrial use, or synthetic fuels production are not projected to have a significant impact on demand for Colorado coal before 1991, although there may be increases as a result of these factors in the mid to late 1990s. Uncertain markets, the cost and availability of transportation, and state and Federal government policies are expected to be the major influence on the expansion of the Colorado coal industry.

o 1986 production from currently undeveloped federal coal leases is likely to add only a small amount to total state production and will be primarily associated with existing mines or to meet due diligence requirements. Leases that are not currently in mine plans are unlikely to contribute significantly to state production by 1986.

o While there is relatively wide variation in the range of projected 1991 production from currently undeveloped federal coal leases, the OTA

projected increases in total Colorado production represent a modest 5-10% annual increase over the decade. At this rate, there could be underutilized coal production capacity in Colorado for existing and proposed mines in 1991 if all are developed as currently planned. However, most if not all of this overcapacity can be expected to disappear in the 1990s as demand continues to grow and some existing mines deplete their reserves.

o Although the number of small mines in Colorado has declined dramatically in the past ten years, the potential viability of small underground mines is still greater in Colorado than for other Western states. Small mines are expected to continue as active contributors to Colorado coal production in the next decade.

Chapter 2

This chapter presents the issues and background information on the development prospects of federal coal leases. This chapter is based on draft issue papers prepared for the Colorado Task Force by Martin Zeller and the Tosco Foundation and on a market study prepared by Joan Martin for the Colorado Energy Research Institute. *

The following topics are discussed in this chapter:

- o Existing Federal Leases in Colorado
- o Colorado Coal Production
- o Coal Markets and Significant Market Variables
- o Transportation Factors
- o Government Policy
- o Federal Coal Management Policies
  - New Federal Leasing
  - Enforcement of the DOI's Diligence Requirements
  - Preference Right Lease Applications
- o Environmental Impacts
  - Water Availability and Quality
  - Air Quality Standards
  - Reclamation
- o - Socioeconomic Impacts

*

Development Status of Existing Federal Coal Leases in Colorado

As of December 1, 1981, there were 127 federal coal leases and 37 pending preference right lease applications (PRLA's) in Colorado. The 127 leases cover over 126,000 acres of federal land and contain approximately 2.2 billion tons of recoverable coal resources. The PRLA's cover almost 83,000 acres and contain over a billion tons of recoverable coal reserves. Of Colorado's total coal land acreage, approximately 53% is federally owned. The remaining 47% are a combination of State, fee and Indian lands.

To determine which leases would be reviewed by the task force, OTA checked the development status of existing leases with the U.S. Geological Survey and the Office of Surface Mining regional offices in Denver. Of the 126 existing coal leases, 49 leases are included in approved mining plans. In 1979, the USGS reported that 24 of these federal coal leases produced 7.9 million tons of coal, or 41% of Colorado's total 1979 coal production. Another 25 existing federal leases are covered by pending mining plans of the OSM and USGS. For the 52 remaining leases, there were no mine plans submitted as of July 1, 1980. These 52, plus 17 other leases which are included in incomplete or inactive mine plans, were classified as undeveloped for the task force analysis. These 69 undeveloped leases comprise 61.5% of the lease acreage in Colorado and encompass 77,733 acres. Undeveloped lease reserves are estimated at 1.47 billion tons of recoverable reserves. Tables 2-1, 2-2 and 2-3 show the mine plan status, location, acreage and undeveloped reserves for the existing federal leases in Colorado.

Colorado Coal Production

A brief examination of the current coal production situation in Colorado illustrates both the significant expansion of coal production which has occurred in the past five years and the potential for future expansion. Colorado ranks seventh in the total U.S. demonstrated reserve base of coal and fourth in the reserve base of bituminous coal. Moreover, Colorado ranks first in the reserve base of underground - mineable, low-sulfur bituminous coal. Coal is found in eight major regions throughout the State and varies from high grade metallurgical coal to lignite. See Figure 2-1. Contrary to the pattern in most western states, Colorado will see an increase in the number of underground mines during the 1980s, which will account for about 60% of the coal mines in Colorado. However, the surface mines will produce approximately 60% of the coal production. In 1978, two-thirds of Colorado's production was mined in the Green River region from 12 surface and 2 underground mines. Due to the generally high grade of Colorado coals, a significant proportion of coal is sold either as blending coal or on the spot market.

Colorado coal production has grown from approximately 8.4 million tons in 1975 to 18.1 million tons in 1979, an average annual increase of approximately 23%. Aproximately 38%, or 7 million tons of Colorado's 1979 production was exported to other states. Of that total, approximately 55% is exported to utility markets in the East and West-North-Central states. Another 20% is exported to other Mountain states, principally Utah and Arizona and approximately 15% goes to California. The State of Colorado consumes about 13 million tons per year of coal of which about 75% is produced in Colorado. Wyoming supplies the majority of imported coal (about

FIGURE 2-1

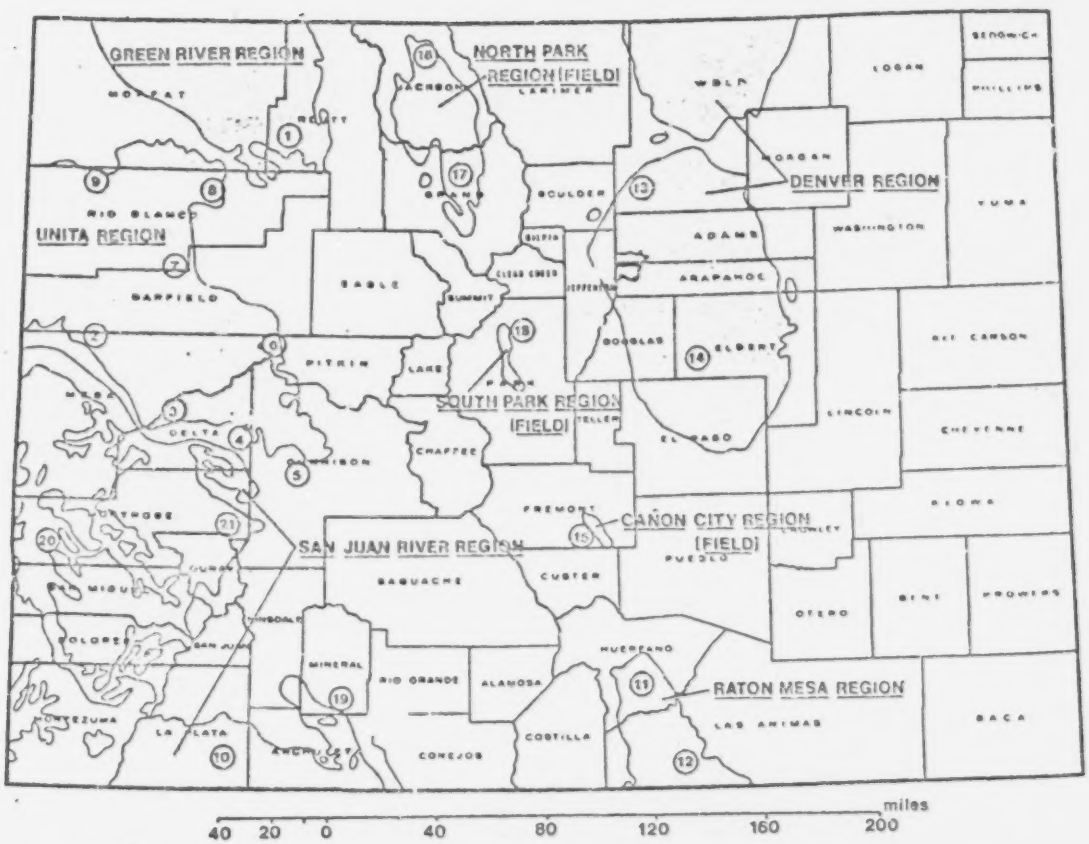


Figure 1. Coal-bearing regions and fields in Colorado.

1. Yampa
2. Book Cliffs
3. Grand Mesa
4. Somerset
5. Crested Butte
6. Carbondale
7. Grand Hogback
8. Danforth Hills
9. Lower White River
10. Durango
11. Walsenburg
12. Trinidad
13. Boulder-Weld
14. Colorado Springs
15. Canon City
16. North Park
17. Middle Park
18. South Park
19. Pagosa Springs
20. Nucla-Naturita
21. Tongue Mesa

TABLE 2-1

LEASE STATUS BY COUNTY

Mine Plan Status

County	Approved	Pending	No Plan Submitted	Designation for Task Force Analysis: Developed	Undeveloped
Delta	5	1	2	5	3
Elbert	0	0	4	0	4
Garfield	0	6	1	0	7
Gunnison*	11	4	13	10	18
Jackson**	(2)new	0	5	(2)new	5
La Plata	1	0	0	1	0
Las Animas	0	0	2	0	2
Mesa	2	6	0	8	0
Moffat	7	0	4	7	4
Montrose	0	0	4	0	4
Ouray	0	0	2	0	2
Pitkin	3	2	1	3	3
Rio Blanco	2	5	7	5	9
Routt	16	1	7	16	8
55	47	25	52	55	69
(57)	(49)			(57)	

*Lease block #11, in Gunnison County includes an additional sublet lease.

**Total number of leases as of 12/31/80 = 124. The two new leases bring the total number of leases as of 9/80 to 126.

TABLE 2-2

Development Status of Existing Leases
by County, Lessee & Number of Leases

Mine Plan[a/] Status	Delta	Elbert	Garfield	Gunnison	Jackson	LaPlata	Las Animas
Approved (Total 49)	• Colorado Westmoreland (2) • U. S. Steel (3)			• ARCO* (1-sublet) • Mid Continent Coal & Coke (6) • Western Slope Carbon, Inc. (4)	• Wyoming Fuels (1) • Kerr Coal Co. (1)	• National King Coal (1)	
Pending (Total 25)	• Beldon Enterprise Inc. (1)		• Sheridan Enterprises (6)	• Anchor Coal (1) • Arco (2) • H&O Weaver (1)			
No Plan Submitted (Total 52)	• Gulf Oil (1)	• Peabody Coal (4)	• Welch & Wiggins (1)	• Kemmerer Coal (1) • Thompson Creek Coal (1) • U.S. Steel (1)	• AMCA Coal Leasing Inc. (1) • Kemmerer Coal (3) • Monolith Portland Cement (1)		• Albert Martinez (1) • CF&I Steel Co. (1)

[a/] As of September 30, 1980.

TABLE 2-2
(continued)

Development Status of Existing Leases
by County, Lessee & Number of Leases
Page 2

Mine Plan Status [a/]	Mesa	Moffat	Montrose	Ouray	Pitkin	Rio Blanco	Routt
Approved (Total 49)	• Cambridge (1) • Gex Colorado (1)	• Colowyo Coal Co. (1) • Empire Energy Co. (3) • Utah International (3)			• Mid-Continent Coal & Coke (3)	• Sewanee (2)	• Energy Fuels (7) • Gulf Oil (4) • Material Service (2) • Peabody Coal (1) • Sunland Mining Corp. (2)
Pending (Total 25)	• James Bros. Coal Co. (1) • Mid-Continent Limestone (3) • Pitkin (1) • Alvin Aul (1)				• Anschutz Corp. (2)	• Moon Lake Electric (1) • Consolidation Coal Co. (3) • Western Fuels (1)	• Prosper Lombardi (1)
No Plan Submitted (Total 52)		• Ferne, James (1) • W. R. Grace (1) • Utah International (2)	• Kemmerer Coal Co. (4)	• Kemmerer Coal Co. (2)	• Garland Coal Co. (1-relinquished)	• Consolidation Coal Co. (6) • Chapman & Riebold (1)	• AMCA (1) • Franklin Real Estate (1) • Peabody Coal (3) Ruby Construction (1) • Sheridan Enterprise (1)

[a/] As of September 30, 1980

TABLE 2-3

LEASE ACREAGE BY COUNTY AND DEVELOPMENT STATUS,

RECOVERABLE RESERVES IN UNDEVELOPED LEASES

COUNTY	UNDEVELOPED LEASE ACREAGE	DEVELOPED LEASE ACREAGE	RECOVERABLE RESERVES IN UNDEVELOPED LEASES (million tons)
Delta	594.99	5,259.89	7.98
Elbert	2,683.68	0.00	48.74
Garfield	15,049.58	0.00	124.18
Gunnison	14,135.84	4,831.32	289.95
Jackson	4,239.67		88.4
LaPlata	0.00	160	0.0
Las Animas	1,001.92	0.00	17.73
Mesa	0.00	10,504.14	0.00
Moffat	6,317.87	8,285.46	290.17
Montrose	6,520.25	0.00	75.5
Ouray	3,561.93	0.00	7.5
Pitkin	5,379.59	4,036.9	59.00
Rio Blanco	11,978.22	3,262.23	420.24
Routt	5,031.09	13,703.24	46.05
Totals	76,494.63	50,043.18	1,475.44

3 million tons in 1979). Approximately 87% of Colorado's total consumption coal is by utilities. (See Table 2-4 and Figure 2-2.)

Since 1971, Colorado has experienced consistent and significant annual increases in coal production. Historically, production came from many small operators, each producing between 1 and 50,000 tons per year. However, as production has increased, the number of operating mines has decreased. Instead, the substantial increases in coal production have come primarily from the larger surface mines in northwest Colorado, which are capable of producing 1 million tons per year. The viability and number of small mines in Colorado has been influenced by several factors: federal regulations concerning mine safety and environmental protection, the retirement of older family operations, and a generally weak market for coal.

As a result of these factors, the characteristics of mining operations have changed. In 1977, there were 68 operating mines. In 1979, there were 56 operating mines, of which 31 were producing less than 100,000 tons per year. Moreover, 5 mines were each producing over 1 million tons per year -- or 51% of total 1979 production.

Despite the fact that Colorado coal production has expanded relatively rapidly in the past five years, there is considerable uncertainty about whether there will be a significant expansion of Colorado coal production and if so, during what time frame. These uncertainties are highlighted by the fact that the coal market in 1980 was so "soft" that a number of mines were stockpiling coal at unprecedented rates and numerous mines either laid off workers or cut back in production. Despite this situation, interest in the January 1981 new leases sale in the Green River Region was high. In 1980-81, several firms were actively acquiring federal and non-federal coal

TABLE 2-4

COLORADO COAL USE BY SECTOR IN 1977 AND 1979

	1977	1979
UTILITIES	80.8%	71.5%
INDUSTRY, COMMERCIAL	18.0%	26.6%
DOMESTIC, RESIDENTIAL	1.2%	1.9%

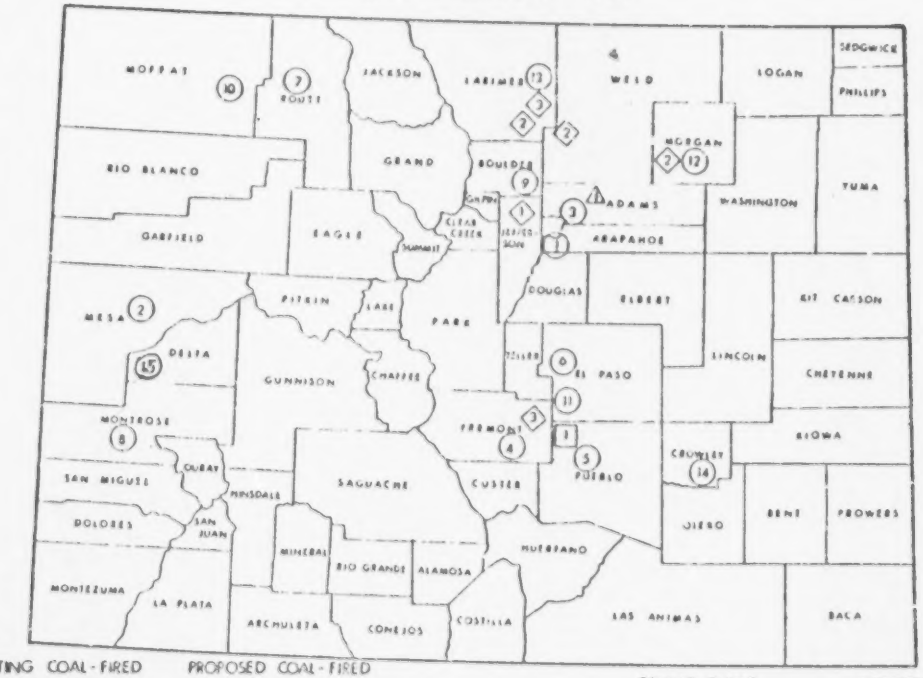
Source: 1977 figures from Colorado Energy Research Institute Energy Fact Book 1980/81

1979 figures from data researched for this paper

N.B. methodologies varied, comparison can only be general

FIGURE 2-2

MAJOR COAL-FIRED FACILITIES IN COLORADO 1979



LEGEND.

EXISTING COAL-FIRED GENERATING PLANTS

1. ARAPAHOE
2. CAMEO
3. CHEROKEE
4. CLARK
5. COMANCHE
6. DRAKE
7. HAYDEN
8. NUCLA
9. VALMONT

PROPOSED COAL-FIRED GENERATING PLANTS

10. CRAIG
11. NIXON
12. PAWNEE
13. RAWHIDE
14. SOUTHEASTERN
15. DELTA

COKING PLANT

1. COLORADO FUEL & IRON (CF&I)

INDUSTRIAL/CEMENT PLANTS

1. ADOLPH COORS
2. GREAT WESTERN SUGAR
   - GREELEY PLANT
   - FT MORGAN PLANT
   - LOVELAND PLANT
3. IDEAL BASIC
   - FLORENCE PLANT
   - FT COLLINS PLANT (1981)

properties in all parts of Colorado. The principal concern among operators was not whether the coal market will firm up, but when.

During the preparation of this report, numerous discussions were held with representatives of government, industry, and public interest groups in order to gain an understanding of the factors critical to determining the 5-10 year potential for Colorado coal and to identify those areas most likely to experience new growth.* A crude consensus developed with regard to regional development potential according to currently available information. Of the eight Colorado coal regions, two -- the Green River and Uinta -- possess a high probability of continued expansion in the 1980s. The North Park region possesses a modest potential for expansion, and the remaining five regions -- Denver, South Park, Raton, San Juan, and Canon City -- were perceived to have a low potential for increased development because of a variety of inhibiting factors. The three factors which surfaced with the greatest frequency were considerations relating to market, transportation, and government, (primarily federal) policy. The following sections discuss these issues in brief and identify particular coal regions or fields in which there are specific concerns.

Coal Markets

The factors and uncertainties which affect the demand for Colorado coal are numerous and intertwined, projections of market conditions are extremely

*A list of persons interviewed by OTA contractors in preparation of this report is included in the Appendix.

difficult to make, However, the ten year time frame of this study prepared for OTA by CERI reduces some of these uncertainties. As detailed in the market study "Market Factors and Contingencies Determining the Present and Future Demand for Colorado Coal," (Part II of this volume) an examination of the production levels planned for existing and proposed mines in the next several years yields an estimate of growth rates below those experienced in the past five years. While existing mines can expand productive capacity relatively quickly, new mines generally require 5-7 years lead time to reach full production. Three of the eight federal lease tracts proposed for sale in Colorado in the 1981 Green River Hams Fork Lease Sale would be extensions of existing operations and any new mines on these leases are not likely to be in production before the late 1980s. Given coal company plans and a modest level of probable new coal development, likely growth rates are well below the annual level of 25% experienced in Colorado in the past five years. The key market factors and uncertainties which might change this scenario are the following: synthetic fuels, foreign export markets, rail transportation costs, future metallurgical coal markets, electricity demand growth, coal conversion programs, and external political events.

Coal Synthetics. The availability of federal and other incentives for construction of coal gasification and liquefaction plants has sparked a great deal of interest in Colorado. While there is much speculation in the Green River, Uinta, and North Park areas about possible plans for synthetic fuels plants, only one proposal by W. R. Grace has actually reached the feasibility study stage. Grace is considering the construction of a coal to methanol plant which would either ship methanol to California directly by pipeline or utilize methanol or carbon dioxide to slurry coal to California markets. As originally proposed the plant would use 1.8 to 2.5 million tons

per year or about 5,000 tons per day of coal, however, in early 1981 the scale of the project was reduced to 500 tons per day and plans for the pipeline were deferred because of economics. Methanol produced at the facility would be marketed in Colorado and neighboring states. Given the long lead times (up to ten years) and massive capital investment ($2 billion required, it is unlikely that this or other plans would be operating at full scale before 1990. A single large coal synthetic fuels plant could, however, have a major impact on the demand for Colorado coal since it is estimated to require between 10 to 20 million tons of coal per year. In addition to the W.R. Grace proposal, there has been speculation about a coal gasification plant east of Denver, a gasification plant in the Coalmont field, an ARCO coal liquids plant in the North Fork, and unspecified synfuel facilities at the Northern Coal property near Meeker and at the Kemmerer Coal tract in the Tongue Mesa. All of these remain highly speculative proposals, since it appears, based on announced construction plans, that most of the first generation of coal synthetics plants will be built either in the East or in the Northern Tier states.

Foreign Export Market: The potential for exporting coal to Japan, Taiwan, and Korea is actively being explored by coal companies and the Western Governors. Three Colorado companies (Snowmass, Westmoreland, and Western Slope Carbon) have sent coal to Japan for sample burns and the Japanese appear to be concentrating their interest on Thompson Creek and North Fork Valley coals. The Japanese are seeking to diversify their supply in the wake of Australian coal strikes and have been looking at a number of countries in addition to the U.S. (Canada, South Africa, Columbia). Colorado coals face severe competition from Utah and New Mexico coals because of their closer proximity, and from Wyoming and Montana coals

because they are recovered by less expensive strip mining techniques. It appears, however, that the Japanese prefer the higher quality Utah and Colorado coals. Colorado could be in a good position to meet some of that demand, particularly if the Intermountain Power Project (IPP) and other Utah projects absorb that state's existing and planned production capacity (assuming southern Utah coal is not developed for a variety of reasons). The major impediments to the use of Colorado coal are higher rail transportation costs, competition from other western states, and the fact that California port facilities with the capacity to handle only 3-5 million tons per year, will require significant upgrading. Given these circumstances, it is unlikely that sales of Colorado coal to foreign buyers will amount to more than 5 percent of total state production over the next ten years, although exports may expand in the mid-1990s. During 1981 additional contracts were completed for sale of Colorado coal to Pacific rim countries and expansion of California port facilities was begun.

Transportation Costs The major competitive disadvantage for Colorado coal is higher rail transportation costs relative to other potential sources. The costs of moving coal over the Rocky Mountains offset two of the main advantages of Colorado coal -- the higher BTU value of most of its coals and state severance taxes which are lower than those of Wyoming and Montana. In many cases, rail rates more than double the cost of coal at the mine. A major incentive cited for the proposed W. R. Grace Synfuels/slurry project was the company's desire to free itself from escalating rail rates that were placing its coal at a competitive disadvantage.

Future Metallurgical Coal Market Two factors, foreign steel imports and impact of environmental regulations on western steel production, threaten

the continued stability of Colorado's metallurgical coal market. The demand for Colorado's high grade metallurgical coal will be increasingly affected by foreign steel imports and the actions which may be taken to protect the domestic steel industry. Currently, most of the metallurgical coal produced in Colorado (3.1 MTPY) supplies either the C F & I plant in Pueblo, Colorado (87% of the Raton Mesa production goes to C F & I) or U.S. Steel's Geneva Plant in Orem, Utah, or Kaiser's Fontana, California plant. Production at U.S. Steel's Somerset mine has been reduced as a result of the fact that the Geneva Plant has curtailed operations pending resolution of air and water quality problems with the E.P.A. U.S. Steel had threatened to close the Geneva facility if requirements placed on the facility make it ureconomic. However, a settlement was reached between U.S. Steel and EPA that will keep the Geneva plant in operation -- maintaining at least that portion of Colorado's metallurgical coal production.

Electricity Demand Growth Since 1973, electrical demand growth rates have declined in most market areas served by Colorado coal. Annual growth rates are now running at between 2-3% per year as opposed to 6-7% per year prior to 1973 and could be lower as the result of conservation. As a result, many utilities have postponed new construction until new demand justifies new investment. The uncertainties surrounding the air quality standards that will apply to new plants reportedly has also been an incentive to defer construction. In Colorado, three new mine-mouth generating plants are proposed by the mid 1990s. Colorado-Ute plans to finish construction of Unit 3 at Craig station in 1983 and Unit 4 sometime in the early 90s. A new Colorado-Ute plant is proposed for either Delta or Mack, Colorado. In October, 1980, Colorado-Ute announced plans for a joint mining venture with Sheridan Enterprises on a currently undeveloped lease block which would

furnish coal to this power plant.

According to the EIS on the Deserado Mine Project), Moon Lake Electric Company plans to use the coal from its three existing federal coal leases and two PRLAs near Rangeley, Colorado, to supply a power plant in Bonanza, Utah. The coal would be transported from Rangely to the power plant site by a 32 mile long conveyor belt. Power from this project would be used to meet the existing demand in Utah and to meet the new demand created by the development of a commercial oil shale industry in both states. All of these proposed plants would be in the range of 400 MW capacity. In addition, Colorado-Ute plans to complete the 345 KV transmission line from Craig to Durango which currently extends from Craig to Rifle. However, Pitkin County has threatened to take the company to court over the proposed location of the line.

Federal Coal Conversion Program The federal coal conversion program, which was launched in 1973 and refined in the Fuel Use Act of 1978, was designed to encourage power plants and major fossil fuel burning installations to shift from using oil and natural gas to coal. To date, only one such major utility conversion has been accomplished. Moreover, with the current glut of natural gas which is expected to continue for several years, the impetus for conversion has dissipated, although oil and gas backout legislation was considered in the 96th Congress. As a result, many of the utilities in the southeast which had originally expected to convert to coal use are no longer planning conversion. Moreover, with the mine mouth costs of Colorado coal more than twice that of cheaper Wyoming coals, Colorado is at a distinct disadvantage in penetrating some potential coal conversion market. Some Texas utilities plan to use local lignite deposits because interstate

transportation charges are so high. With over 100 MTPY of excess coal production capacity existing in the West, Colorado coal faces severe competition with other states in meeting the limited demands of those utilities and industries converting to coal.

External Political Events The ever present possibility of turmoil in the Middle East and the possible curtailment of oil exports to the U.S. could drastically change the demand picture for coal. The pace of synfuels development, coal conversion, and federal leasing could be stepped up dramatically in response to supply interruptions however, with long lead times required for new mine construction, increased coal production offers only a long-term solution to disruptions in oil supplies.

Estimates of Colorado Coal Production in 1986 and 1991

Despite the difficulties involved in estimating the future markets for Colorado coal because of the uncertainties and issues identified above, a forecast of likely production over the next decade was derived for use in the OTA Colorado task force.*

The coal projections were developed by surveying and studying all currently operating and proposed mining operations. This "bottoms-up" mine-specific approach yields a conservative picture of likely production levels for the next ten years. The projections were adopted by the Colorado task force, with some modifications, as a low level estimate of Colorado coal production in the next decade. The market scenario thus adopted was used as one measure of the development prospects of existing federal leases. The discussion which follows is drawn from the report prepared for OTA under the sponsorship of the Colorado Energy Research Institute.

A number of analyses with high scenarios such as DOE's Biennial National and Regional coal production goals have predicted that Colorado could experience an accelerated rate of coal production over the next decade. An historical review of Colorado coal production may also encourage expectations of accelerated mining activity, since growth rates tripled during the late 1970s. However, a mine-specific study and survey suggests that coal production in Colorado will experience more moderate increases during the 1980s than some have anticipated.

*"Market Factors and Production Contingencies Determining the Present and Future Demand for Colorado Coal" prepared for the Colorado Energy Research Institute by Joan E. Martin of Fred C. Hart Associates, Denver, Colorado, Final Draft, December 1980.

Based on this data, the market for Colorado coal will continue to be weak through the late 1980s and it is likely there will not be enough demand to absorb all the coal available from existing mines, currently proposed mines, new federal lease sales, and PRLAs. The market study projects total annual production in Colorado to increase at a moderate rate from 18.13 million tons in 1979, to 24.6 - 25.9 million tons in 1986, and to 26.0 to 34.8 million tons in 1991.

The first number of the range indicates coal production projected from existing and highly probable contracts. The second number of the range represents a reasonable estimate of additional production from new foreign markets, new spot market contracts for test burns, and due diligence regulations. It was arrived at through discussion and concensus of the OTA Colorado Coal Leasing Task Force.

These projections are consistent with the medium and low scenarios forecasted by the Department of the Interior and the Department of Energy, except that no synfuels from coal are anticipated by 1991. (See Appendix A-1 for excerpts from Department of Energy 1985, 1990 and 1995 production goals.)

Metallurgical coal will remain second in production to steam coal. Under current market conditions, production demand for metallurgical coal, all mined underground, will remain stable at 3.1 million tons per year through 1991 while the production of steam coal increases. A potential variable is that the market for metallurgical coal could be severely affected by the closing of Western steel plants. If the Provo Plant in Utah is closed, production would be decreased by approximately 20 percent.

Surface mining production, which first surpassed underground mining production in Colorado in the mid-1970s, is expected to reverse its role again. It is now anticipated that underground production will surpass surface production between 1986 and 1991. The major reasons for this trend are the depletion of strippable reserves in Northwest Colorado, and the increase in underground production from both Northwest and West Central Colorado.

By mining method, the production projections are:

1986 surface	14.0 - 14.7 million tons (55 - 52%)
underground	10.6 - 11.2 million tons (45 - 48%)
1991 surface	11.5 - 15.3 million tons (45 - 46%)
underground	14.5 - 19.5 million tons (55 - 54%)

The most productive coal area in the State is the Yampa field in the Green River Region. There are currently 11 mines producing almost ten million tons per year in the Yampa field. Production there is expected to increase to 11.5 million tons per year in 1986 and drop to 8.7 million tons per year in 1991. The Yampa field faces the greatest market competition (projected production by region and field is detailed in Table 2-5).

The CERI report cautioned: "With all these market determinants and uncertainties, it is difficult and misleading to generalize or summarize the market potential for Colorado coal. It should be recognized that there currently is overcapacity in Western coal fields. In 1979, almost 1.2 million tons of coal were stockpiled. Colorado is judged to have a production capacity from existing mines only of 37 million tons per year."

TABLE 2-5

PRODUCTION FROM ACTIVE COAL REGIONS
AND FIELDS IN COLORADO

Region and Field	Production (million tons) Current	1986	1991
Canon City Region			
Canon City Field	.165	—	1.68
Green River Region			
Yampa field	9.0	11.5	12.1
North Park Region			
North Park field	.785	—	.1
Raton Mesa Region			
Walsonberg field	.05	.05	.05
Trinidad field	.80	.883	.933
San Juan River Region			
Durango field	.095	.095	.095
Nucla field	.123	.123	.123
Pagosa Springs field	.079	.079	.079
Uinta Region			
Book Cliffs field	.908	3.55	3.55
Carbondale field	.842	.895	.895
Crested Butte field	.0003	.002	.0
Danforth Hills field	4.074	4.2	4.2
Grand Hogback field	.0006	.001	.001
Grand Mesa field	.081	.11	.11
Somerset field	2.4	4.14	3.99
	19.403	25.628	27.906

Source: "Market Factors and Uncertainties Determining the Present and Future Demand for Colorado Coal", Part II of this report.

The most significant factors affecting future contracts and production of Colorado coal identified by CERI are:

- o electricity demand growth
- o coal transportation;
- o synfuels from coal; and
- o foreign markets.

The most uncertain factors affecting future contract and production of Colorado coal are:

- o synfuels from coal;
- o foreign markets; and
- o industrial markets.

According to CERI's survey, Colorado coal will continue to be used in older Colorado utilities designed for Colorado coal. Several of the newer Eastern Slope power plants were designed to burn Wyoming coal. Major power plants under construction and proposed for the Western Slope (Colorado Ute's Southwestern, Craig Unit No.3, and Moon Lake Electric's facility) will burn Colorado coal.

Few large, long-term contracts will probably be cancelled, so out-of-State utility and industrial markets will remain. However, some options, smaller contracts, and spot market contracts have been cancelled. It is difficult to predict whether this trend will continue or reverse itself in the next ten years.

Colorado coal producers have competition from every direction. Geographically, Colorado coal is in the middle of the Western coal deposits

but on the wrong side of the mountains for present markets. As long as coal transportation plays such a significant role, it will be difficult for Colorado coal to be competitive with Wyoming, Montana, Utah, and New Mexico coals, as well as with the Midwestern coals and the Southern lignites. The trump card is the uniqueness of Colorado coals. Existing markets with older facilities needing new fuel sources and foreign markets want coal with the characteristics found in Colorado's deposits of bituminous and subbituminous reserves.

The Green River-Hams Fork and the Uinta coal regions have traditionally been the greatest producers of Colorado coal during the last decade. This will continue to be the case. These are the regions capable of responding to potential new markets.

Currently the market for Colorado coal are soft, but there are several new potential markets. It is concluded that the markets will remain soft and that production will only increase at a moderate rate through 1988. With much less certainty, it is concluded that this trend will change in the late 1980's as new markets develop, and Colorado coal production will increase at greater rates after 1991.

The assumptions used in deriving the estimates of future Colorado coal production, as modified by the OTA task force are as follows:

- The present lack of firm long-term contracts for Colorado coal will continue.
- The substantial increases in rail rates for coal shipments are not expected to be reversed or delayed.

- o Nuclear power plants that are currently in use or under construction will continue in operation.

- o EPA new source performance standards for new electric generating plants will continue to favor Eastern and Midwestern coal by requiring scrubbing for all coals.

- o Colorado coal will continue to face substantial competition in all markets, including:

  - Competition from Wyoming and Montana coal in Midwestern, South Central, Northwestern, Western, and Colorado Front Range markets. (Several new power plants in Eastern Colorado will be supplied with Wyoming coal.)

  - Competition from Utah and New Mexico coal in Southwestern and Western markets.

  - Competition from foreign coal imports in Southwestern, South Central, and Western markets.

  - Competition from lignite coal in the South Central states for the South Central market.

- o Large increases in natural gas supplies will postpone the conversion of oil and gas boilers to coal in the South Central states.

- o There will be few new conversions to coal by industrial users, since most of the Colorado industries using natural gas switched to coal in the early 1970s.

- There will be no commercial scale coal synthetic fuel plant using Colorado coal by 1991.

- Demand for metallurgical coal will remain stable, or possibly, decrease if some Western steel plants close.

- Despite the fact that several Colorado coal companies have sent coal to Japan for sample burns and the Japanese have shown interest in high quality Colorado coal as a means to diversify their supply, it is unlikely that the export market for Colorado coal will increase significantly before 1991.

- A mine must have a proposed mine plant by 1980 in order to be in production by 1986. According to industry estimates it requires between six and eight years from the initial lease acquisition to open a new mine in Colorado and an additional two years to reach full production.

- Federal leasing will proceed on schedule and according to the final coal management regulations. No Colorado tracts will be delineated and offered in the 1981 Uinta or 1983 San Juan Basin lease sales.

- Federal leases sold in the 1981 Green River-Hams Fork lease sales will not contribute to increased coal production in Colorado until after 1991. Most output from new leases that are contiguous to existing operations will be used to maintain levels of production under existing contracts, rather than increase production. Because of the lead time required, new mines on 1981 lease tracts will not reach full production by 1991.

- Federal PRLA's producing by 1991 will be those that are contiguous to existing operations or those that are part of currently proposed mine plans.

- Several new mines will go into operation before securing firm contracts for their production because of federal diligence requirements and other considerations.

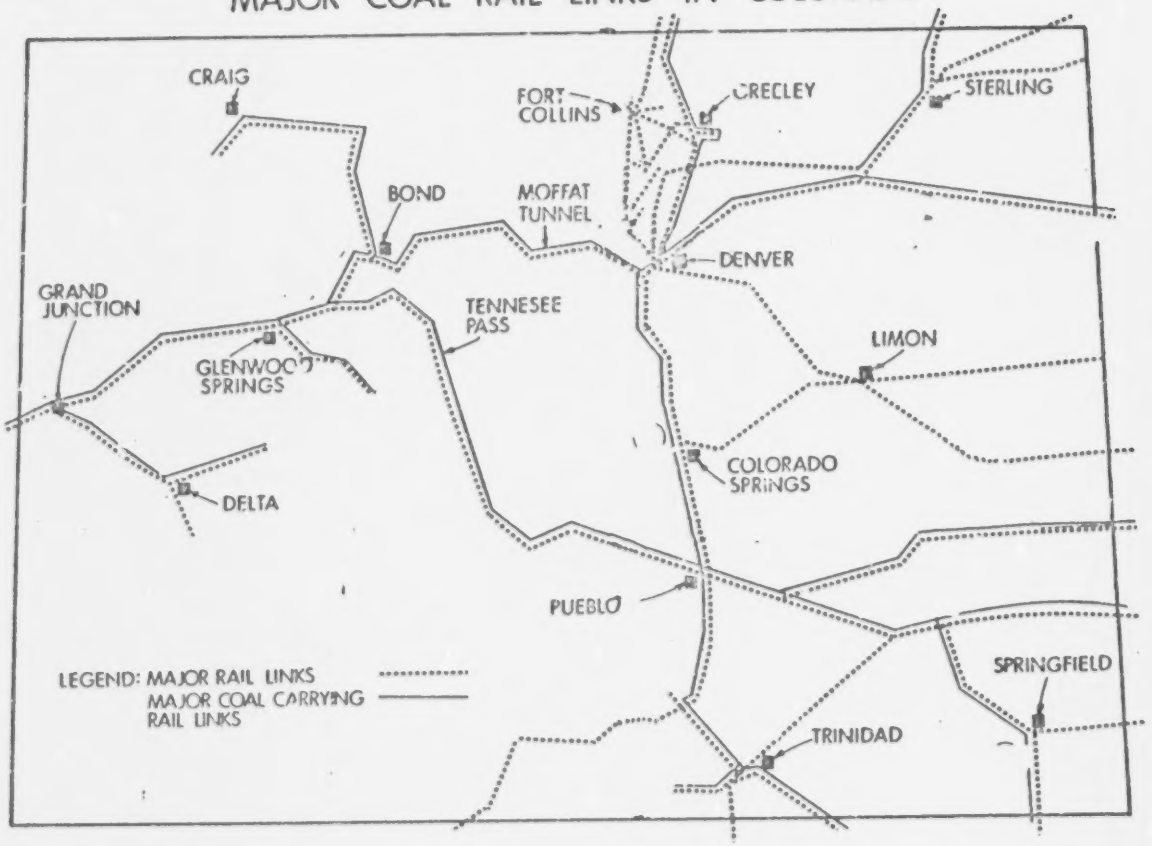
Transportation Issues Affecting Colorado Coal Development

Transportation availability plays a major role in determining the market and development potential of Colorado coal (Figure 2-2). For example, until the Durango Field in the Northern San Juan River coal region is served by rail, it is unlikely that significant new mine development will take place there. Currently, the nearest railhead is in Gallup, New Mexico. Several of the currently undeveloped federal coal leases are located in other areas that are either unserved or poorly served by rail transportation. The federal leases in the Coalmont field of the North Park region probably cannot be developed until the abandoned Union Pacific (U.P.) line from Walden to Hebron is substantially upgraded. The U.P. line north from Walden which is currently serving two active mines (Wyoming Fuels and Kerr), has sharp turning radii and steep grades which will make upgrading of the line difficult and costly. The lack of rail access and the high cost of rail spurs which require large long-term coal supply contracts to offset construction costs can inhibit development on otherwise viable properties.

Many coal companies in Colorado face the problem of truck hauls of from two to thirty miles to railheads at substantially increased costs. This situation is common in virtually all currently developed coal fields in Colorado. Some companies, like Colorado Westmoreland, are considering conveyors as alternatives, others like Sheridan Enterprises propose a rail spur, and others like Dorcester cannot economically justify either of these alternatives and will continue to use public haul roads which they have helped to maintain or resurface. Northern Coal Company, which currently hauls coal 30 miles north to Empire Energy's loading facility near Craig is examining the possibility of railroad lines from both the north and the

FIGURE 2-3

MAJOR COAL RAIL LINKS IN COLORADO



south. The northern line would be an extension of the existing Colowyo spur. The southern spur would come north from Rifle through Meeker. Northern is currently discussing the possibility of joint construction of the southern spur with a number of oil shale developers since the local road system would soon be overloaded handling materials transport with the construction of several oil shale facilities. Without this spur, Northern would probably truck its production to the Colowyo Spur.

Perhaps the most hotly debated transportation issue in Colorado is railroad rates rather than access to transportation. Most of the operators in the Green River region, which is the State's largest producer, complain that rapidly escalating rail rates are destroying their competitiveness with other coal producing states, since access to Craig is controlled by a single carrier the Denver and Rio Grande Western (DNRG). The DNRG responds that its rates are fair and reflect the high costs of upkeep on difficult sections such as the Moffat tunnel, new railroad sidings to increase capacity, and the installation of automated traffic handling systems.

The high rail costs of shipping coal from northwestern Colorado have lead to investigations of other alternatives. For years there has been talk of a line extending southward from the main U.P. line in Rawlins, Wyoming, to Craig. U.P. has investigated the route and identified possible corridors. Several of the lease blocks in the Green River Hams Fork lease sale would be adjacent to this line. However, construction of this line is unlikely in the near future under the current regulated railroad structure. U.P. has no active plans for the construction of the spur which would be necessitated only if substantial coal capacity were under contract from currently undeveloped areas in Wyoming and Colorado.

Coal slurry pipelines are the other alternative being considered to move Colorado coal to potential markets. However, the Colorado Legislature has barred the exportation of Colorado water and the ongoing heated competition for scarce water supplies between oil shale companies, existing and proposed generating plants, and agricultural uses demonstrates that coal slurry pipeline proposals will run into a great deal of opposition in Colorado. The only active coal slurry pipeline proposal in the state is the San Marco project which would slurry coal from Walsenburg, Colorado, to Houston, Texas. Coal would be brought by rail from throughout Colorado to Walsenburg where it would be pulverized, mixed with water, and fed into the pipeline. Proponents claim that they will be mining a brackish underground aquifer which will not affect clean water supplies. Given Colorado's position on the exportation of any water, however, it is likely that the project will be unable to proceed without either federal enabling legislation or resolution of the water rights issue in court.

The capacity of the DNRG to move coal from western Colorado to the front range, through the Moffat tunnel is open to speculation. The EIS on the Green River Hams Fork Coal Lease Sale found that under the preferred leasing alternative, the DNRG would be at 86% capacity. The DNRG states emphatically that there is no problem meeting future coal demands. However, the combined effect of moving coal, supplying materials to the nascent oil shale industry, oil and gas industry, power plants, and uranium development raises questions about whether there might be some overloading. However, under the CERI moderate market projections for Colorado coal production, overloading of existing rail capacity does not appear to be a significant likelihood.

The problem of adequate grade crossings and separations is one faced daily by communities throughout Colorado. Along the front range, the combined effects of Colorado and Wyoming unit train coal traffic have caused accidents and long waiting lines at crossings. Although major rerouting and grade separation have been proposed along the front range, implementation of these measures have been delayed because of the difficulties in allocating the costs between the railroads, government, and consumers. In rural areas, grade crossing problems can also be severe in small mining towns where coal trains can temporarily block access by fire and rescue equipment to areas near the tracks.

Government Policies Affecting Coal Development

A principal ingredient in assessing the magnitude of coal development in Colorado is consideration of the impact of government policies, regulations, and uncertainties. One of the most commonly cited impacts is that the combined effect of federal and state legislation governing health and safety, environmental impacts, and energy development enacted since 1970 has contributed to the disappearance of the small operator and has further concentrated leaseholdings in the industry. Whether government policies and regulations have in fact had this effect or whether the changes in the industry are merely evolutionary, adjustments to competition is a matter of great debate. Whereas in the past there have been many small Colorado mines producing less than 200,000 TPY, it is unlikely that many small new mines will be opened in the future except under highly localized circumstances. The Colorado task force concluded that opportunities for new small mines will continue to exist over the next decade for local use and the spot market.

Government policies and regulations such as coal conversion requirements, synfuels incentives, air and water quality standards, federal land management policies, and programs for competing energy sources such as nuclear, power conservation, solar and other alternative energy technologies, have a profound impact on coal development, both positive and negative. The CERI report concluded that the present situation is ambiguous as to whether the combined effect of these actions and currently unresolved issues will be stimulative or depressive in nature for the Colorado coal industry.

Federal Coal Management Issues

Three issues related to federal coal management policies could influence the development potential of existing federal leases in Colorado by affecting the availability of federal lease reserves that could compete with existing leases for a share of the Colorado markets. They are: new federal leasing, the processing of pending preference right lease applications and the enforcement of the department's diligent development requirements.

New Leasing

The Department of the Interior ended the nine year moratorium on most federal coal leasing in June 1979 with the implementation of a new coal management program. Seven Colorado tracts will be offered in the first new lease sales under the new program--the Green River-Hams Fork in 1981. No Colorado tracts will be offered in the 1981 Uinta Basin sale, or in the 1983 San Juan Basin sale. In addition to new tracts delineated and nominated through the tract selection process in the new coal program, several competitive lease applications are also pending for production maintainance at existing mines. Many such leases were issued in Colorado during the leasing moratorium (see Appendix for a list of pending competitive lease sales applications in Colorado). Processing of the 37 pending preference right lease applications is also a source of new competing leases. PRLAs are discussed in the following section.

The 1981 sale will offer 11 lease tracts in the Green River-Hams Fork region of Northwest Colorado and southern Wyoming, containing an estimated 450 million tons of in-place coal reserves. Seven of the tracts are in

Colorado and five tracts are in Wyoming. (See Appendix C for a map showing the location of the new leasing tracts.)

The sale is designed to yield a total of 13 million tons of new coal production per year by 1987 from new mines on seven of the tracts. Production from the remaining four tracts will be used to maintain or expand existing operations. New annual production on five of the Colorado tracts is expected to total 7.4 million tons by 1987. The two new mines planned for the Wyoming tracts are projected to produce 5.5 million tons of coal annually by 1987.

Among the leases offered is the first federal lease specifically designated for DOI's small business set-aside program. This is a cooperative effort between DOI and the Small Business Administration to ensure that small and disadvantaged businesses are given an opportunity to lease Federal coal. Although small businesses are not prevented from bidding on other tracts, only small businesses will bid for this lease.

The sale will be held in three parts beginning in January, 1981, and continuing with additional offerings in April and October, 1981. The scheduled Colorado lease tracts are shown in Table 2-6 below and Figure 2-4.

The 13 million tons of anticipated new annual regional production is designed to meet DOE's projected 1987 regional shortfall of 18.5 million tons. The Interior Department has set a final leasing target of 520 million tons of total in-place federal reserves. The targets include a 25 percent security factor to account for the likelihood that not all coal offered for lease will be mined, to promote competition, and to allow existing mines to maintain current levels of production.

A related Interior Department action could also increase federal coal

production in the Green River-Ham's Fork region. The Red Rim Tract in Wyoming, with an annual production potential of two million tons, will be offered in the new lease sale of October, 1981, if the Regional Coal Team decides that production will not disturb the antelope winter range on the tract.

Expressions of industry interest and geologic and mining information were used to delineate 17 tracts in the region for potential leasing. The Regional Coal Team dropped one tract because of insufficient data. Three tracts were dropped from consideration because of environmental and socioeconomic conflicts. One tract was deleted with the intention of offering it in combination with a larger tract at a later sale, thus enabling greater coal recovery from the same area.

TABLE 2-6

DATE	TRACT	COUNTY	ANTICIPATED LEVEL OF ANNUAL PRODUCTION	IN-PLACE RESERVES
January 13, 1981	Danforth Hills #1	Moffat	Maintenance	40 Mt
	Empire	Moffat	0.5 Mt	32 Mt
	Grassy Creek	Routt	0.1 Mt	2 Mt
April, 1981	Danforth Hills #2	Moffat	1.8 Mt	105 Mt
	Danforth Hills #3	Rio Blanco	2.2 Mt	107 Mt
	Hayden Gulch	Routt	2.8 Mt	94 Mt
	Pinnacle	Routt	Maintenance	1 Mt

Preference Right Lease Applications

There are currently 37 pending preference right lease applications for federal coal lands in Colorado. The 37 PRLA's cover a total of 82,910 acres of federal land and contain approximately one billion tons of recoverable coal reserves. (See Table 2-7.) Overall, the 37 PRLA's contain an estimated 1.7 billion tons of in-place reserves, and about one billion tons

TABLE 2-7
COLORADO PREFERENCE RIGHT LEASE APPLICATIONS

Coal Basin

Lessee (assignee/operator)	Serial Number	Date	County	Acres
Green River Hams Fork				
Russell W. Chapman & Paul E. Riebold	C0125366	8/18/69	Moffat	640.00
Kemmerer Coal Co.	C0125854	11/20/69	Jackson	440.00
& Consolidation Coal Co.	C3605	4/26/74	Routt	2984.00
	C3606	4/21/72	Moffat	2984.00
Utah Int'l, Inc.	C0123475	11/19/68	Moffat	2082.00
San Juan				
Kemmerer Coal Co.	C0120075	5/24/68	Ouray	1203.00
	C0124288	1/7/69	Montrose	2254.00
Uinta-Southwestern Utah				
Northern Minerals Co.	C0126997	4/30/69	RioBlanco	3566.00
	C0126999	4/20/70	RioBlanco	960.00
Consolidation Coal Co.	C0126998	8/20/70	RioBlanco	5099.00
Gerald T. Tresner	C0127832	9/30/70	Garfield	4522.00
(Dorchester Colomine)	C0127833	9/30/70	Garfield	5087.00
	C0127834	9/30/70	Garfield	5120.00
Jensen & Estate of K.W. Miller (Northern Minerals)	C4275	3/30/73	RioBlanco	480.00
Western Fuels Assoc.	C8424	6/30/71	RioBlanco	2552.00
	C8425	6/30/72	RioBlanco	560.00
Reliable Coal Mining Co. (Western Fuels Assoc.)	C0126669	2/26/70	RioBlanco	259.00
Denver-Raton Mesa				
Meadowlark Farms Inc.	C8257	3/21/74	Elbert	345.00
	C8258	3/21/74	Elbert	2771.00
	C8259	3/21/74	Elbert	3944.00
	C8260	3/21/74	Elbert	1361.00
	C8261	3/21/74	Elbert	328.00
	C8263	3/21/74	Arapahoe	3352.00
	C8264	3/21/74	Adams	2053.00
John W. Hand	C8265	3/15/74	Adams	160.00
Consolidation Coal Co.	C17163	3/29/74	Elbert	2240.00
	C20473	3/29/74	El Paso	2560.00
	C20474	3/20/74	El Paso	2807.00
	C20475	3/29/74	Elbert	402.00
	C20476	3/29/74	Elbert	480.00
	C20477	3/29/74	Elbert	3155.00
Mobil Oil Corp.	C8123	8/29/74	LasAnimas	2722.00
	C8127	8/29/74	LasAnimas	4400.00
	C8129	4/17/74	LasAnimas	991.00
	C8134	8/29/74	LasAnimas	3876.00
	C8135	8/29/74	LasAnimas	3823.00
	C8136	4/17/74	LasAnimas	348.00

of recoverable reserves. Total and recoverable reserve estimates for the PRLA's, grouped by coal basin, are summarized in the following table.

TABLE 2-8

COLORADO PRLAs

BLM Coal Production Region	#PRLAs	Total In-Place	Total Recoverable Reserves
Green River-Hams Fork	5	107.57	61.27
San Juan River	2	30.0	10.01
Uinta-Southwestern Utah	10	539.61	229.64
Denver-Raton Mesa	20	989.5	740.51
	37	1,666.68	1,041.43

The Department of the Interior plans to process all the PRLA's by 1984 under the provisions of the new federal coal management program. New leases will be issued to applicants who demonstrate that they have discovered a commercial coal deposit that can be mined at a profit after consideration of all the costs of complying with the lease terms and all applicable laws and regulations. Processing will be conducted as part of the BLM land use planning efforts and will include consideration of whether issuance of the PRLA is compatible with the land use plan. BLM District offices are currently reviewing the PRLAs, preparing environmental analyses, applying the unsuitability criteria and drafting recommendations as to their ultimate disposition. Several of the PRLAs are included in proposed mine plans (although a permit cannot be issued for the PRLA area until after a lease is issued). For example, Moon Lake Electric's plans for a mine near Rangely include two PRLAs in addition to its existing three leases. Consolidation Coal's federal leases north of Meeker are joined by an adjacent PRLA as are Kemmerer's lease holdings in the Tongue Mesa Field. The proposed Dorchester

Colomine operation in Loma is contingent upon the approval of three PRLAs.

Some applicants, such as the Dorchester Colomine venture, have pressed for early adjudication of their PRLAs and have proceeded with mine plan development before actually obtaining leases for their PRLAs. These applicants will then be ready to develop their PRLAs quickly once the leases are issued.

However, even if all the PRLA's are converted into leases by 1984, it is unlikely that large scale production would begin on most until after 1990 because of the lead time required to conduct developmental drilling, prepare a mine plan, and construct the mine and supporting facilities. The PRLA's represent an important competing source of coal for the 1990's market. As new leases, the PRLA's will be subject to requirements in FCLAA requiring submittal of a mine plan within 3 years of issuance and the initiation of commercial production within 10 years.

ENFORCEMENT OF DILIGENCE REQUIREMENTS*

In May 1976, the Department of the Interior promulgated regulations that interpreted the requirements of Section 7 of the Mineral Leasing Act which provided that federal coal leases could be held for "indeterminate periods upon condition of diligent development and continued operation of the mine or mines, except when such operation shall be interrupted by strikes, the elements, or casualties not attributable to the lessee." The regulations specified that federal coal leases, with few exceptions, must produce coal in commercial quantities from the logical mining unit (LMU) reserves of the leasehold by June 1, 1986. Commercial quantities was defined as production equal to one fortieth (2 1/2%) of the LMU reserves. Once the lease has begun commercial production, the lessee must also satisfy the continuous operation requirement, which is defined in the regulations as mining at an annual average rate of one percent of the lease reserves. If the lessee fails to meet the diligent development and continued operation requirements, collectively referred to as "diligence requirements," the lease is subject to cancellation. The Federal Coal Leasing Amendments Act of 1976 modified section 7 to require that new leases must be in production within 10 years but left undisturbed the department's 1986 diligence requirements for existing leases.

Based on OTA's review of the undeveloped federal leases and an examination of the Department's diligence requirements, OTA has concluded that it is unlikely that application of diligence requirements will result in the termination of all leases that are not in production by June 1, 1986.

*Those interested in a more thorough discussion of diligence issues should consult OTA's final report, An Assessment of Development and Production Potential of Federal Coal Leases, issued in December 1981.

Accordingly, task force members were asked to assume that leases which were considered favorable for development by 1991 would qualify for an extension of the diligence period. There are many reasons why the June 1986 date may not represent an absolute deadline.

1. The diligence regulations are applied to LMU's as well as leases. One or more leases can be combined into an LMU with approval of the Department. Production for the entire LMU is then the basis for the diligence determination. The regulations specify that all lands in a designated LMU must be contiguous, under the control of a single operator, and capable of being developed and operated as a unified operation with complete extraction of the LMU reserves within 40 years from the date of first approval of a mining plan for that LMU. Many nonproducing leases could be combined with producing operations on contiguous lands to form an LMU and thus meet diligence.

2. Lessees may qualify for an extension of the diligence period under certain circumstances if diligent development is significantly impaired by:

a. a strike, the elements, or casualties not attributable to the lessee;

b. an administrative delay in the Department that is not caused by the lessee's action; or

c. extraordinary circumstances not attributable to the lessee and not foreseeable by a reasonably prudent operator.

If any of these conditions are found the Secretary can authorize an extension for a period equal to the delay in development. Extraordinary conditions exclude any condition arising out of normally foreseeable business risks such as: fluctuations in prices, sales, or costs, including foreseeable costs of compliance with environmental protection requirements; commonly

experienced delays in delivery of supplies or equipment or inability to obtain sufficient sales.

3. The Secretary may grant a single 5 year extension for any of the following:

a. additional time needed to complete development of an advanced technology such as in situ gasification or liquefaction processes;

b. additional time required because of the magnitude of the project involved. (Magnitude is generally defined as meaning, but not limited to, a mine producing two million tons a year by underground methods or five million tons per year by surface operations in the first year after the extended diligence period);

c. a contract which is a firm commitment for the sale or use of the first one fortieth of the LMU reserves after the ten year period (i.e. after 1986).

Regardless of the reason for the extension, the lessee must produce the first one fortieth of the LMU reserves before the end of the extended term. In 1980, the Department requested public comments on the guidelines to be used in granting diligence extensions under the above discretionary criteria.

4. Failure to attain diligent development for leases issued before August 4, 1076 does not result in automatic termination of the lease. The lease becomes subject to cancellation, which means that the Department of the Interior can request that legal proceedings be commenced against the lessee to have the lease revoked for violation of the lease terms and governing regulations. Enforcement action in federal court would be conducted by the Department of Justice. There is no requirement that the Department of the Interior or the Attorney General actually commence cancellation proceedings

for violation of diligence requirements. Indeed, it can be expected that the Department will rely, to a large extent, on voluntary compliance with the diligence requirements. If and when the Department proceeds with enforcement action against a nonproducing lessee, the first cases will probably be carefully chosen because of some of the legal uncertainties involving application of diligence requirements to existing leases. (In contrast, FCLAA provides that new leases not producing within 10 years "shall be terminated." Termination is an administrative proceeding.)

5. The Secretary can use his authority under the Mineral Leasing Act to suspend the terms of an existing lease, thus suspending the diligence term, or to approve a modification of the lease to reduce the amount of the LMU reserves and thus the level of production required. Finally, the Secretary can waive violations of the lease terms or regulations and thus, informally, extend or modify application of diligence requirements under his general discretionary authority to administer leases in the public interest. Department policies provide that a violation of lease terms is not formally waived except in writing to the lessee.

The influence of enforcement of diligence development and continued operation requirements on the timing and magnitude of development of new coal operations in Colorado remains unclear. Many undeveloped leases could qualify for extention of the 1986 deadline. Some of the undeveloped lease blocks are sizable tracts that could conceivably support large mines or synthetic fuel projects. Several underground mines are installing advanced longwall mining equipment, although this is not a new technology, its use in thick, western coal seams is a recent application that is expected to increase coal recovery. These leases could arguably qualify for discretionary extensions of

the diligence period until 1991.

ARCO has submitted a mining plan for the new 2.8 million ton per year Mt. Gunnison mine in the North Fork area without any firm contractual supply commitments. The company had hoped to supply Colorado-Ute's projected new plant in southwest Colorado. The decision to open the mine, ARCO officials state, was to satisfy diligence requirements. Another lessee, CF&I, which holds several leases in the Raton region has been seeking to exchange its existing lease for lands adjacent to existing operations since it feels that it will be unable to meet due diligence requirements. Currently, however, DOI lacks the general authority to permit such lease exchanges. According to one industry source interviewed by OTA contractors, uncertainty surrounding diligence requirements has tended to encourage utilities to contract with existing, already proven mines.

Note: In December 1981, revised diligence regulations were proposed for both pre-1976 leases and post FCLAA-leases. OTA's preliminary analysis indicates that the proposed changes would, on the average, give existing lessees an additional 3 to 7 years more beyond 1991 to meet diligence at a production level of one percent of recoverable reserves. For pre-FCLAA leases, these requirements would become effective at the next readjustment date.

Environmental Impacts

The environmental effects of coal production can be classified as temporary or permanent, and as localized or regional in scope. Whereas the degree of localized physical disturbance is most closely associated with the type of mining technique employed, regional effects are more closely associated with overall patterns of energy development and resulting changes in infrastructure. (See discussion on Socioeconomic Impacts.)

The major issues that emerge from the prospects for expanded coal production in Colorado are the effects that this will have on the availability and quality of water resources, the possible deterioration of air quality, the impacts on competing surface values, and the potential for successful reclamation.

Water Availability and Quality

The issue of water rights is particularly pronounced in the North Fork of the Gunnison where rich agricultural and orchard land is adjacent to several mines in a narrow valley. In addition to fears about the loss of water rights to energy companies, there are lingering questions as to whether the proposed Mt. Gunnison mine will divert underground water supplies thereby depriving local farmers of their water. Since ARCO owns most of the rights to water in Paonia Reservoir, (leading to speculation about a synthetic fuels plant which ARCO says it has dropped from the drawing board) farmers could potentially be compensated for any losses, however, ARCO's purchased water rights are lower in priority of use than the agricultural uses that they might be used to replace.

The proposed Colorado-Ute power plant six miles NW of Delta is 15 miles from a hydroelectric dam site in Austin. The [illegible] 1 for a 42,000 acre foot dam is currently pending before FERC. Presumably, water from the dam would be utilized for power plant cooling.

The long range impacts of population growth and energy development on the Colorado River have yet to be quantified. However, it is clear that any consumptive use, such as new energy development, adds to the downstream salinity problems in the Colorado River.

The availability of scarce water is one of the chief limiting factors for energy development in Colorado. Water requirements for coal mines are relatively small (dust control and reclamation) compared to the requirements for synthetic fuels plants and coal-fired generating stations. The water needs of the potential oil shale industry on the western slope are projected to be quite large. The principal shortage in Colorado is in storage capacity. As a result, many of the major energy development proposals include the construction of new localized reservoirs or anticipate participation in the construction of new regional reservoirs. It is generally agreed that there is adequate water in the White and Yampa rivers in northwestern Colorado to support sizeable new mining and conversion facilities provided new reservoirs are created. Several new regional projects are proposed to meet the new demands including the Yamcolo Reservoir, Yellowjacket Project, and the largest, the Juniper/Cross Mountain Reservoir. The Juniper/Cross Mountain project consists of two reservoirs with a combined capacity of one million acre/feet. Currently, the project is located in a proposed BLM wilderness study area which conflicts with reservoir construction. However, it is anticipated that these difficulties

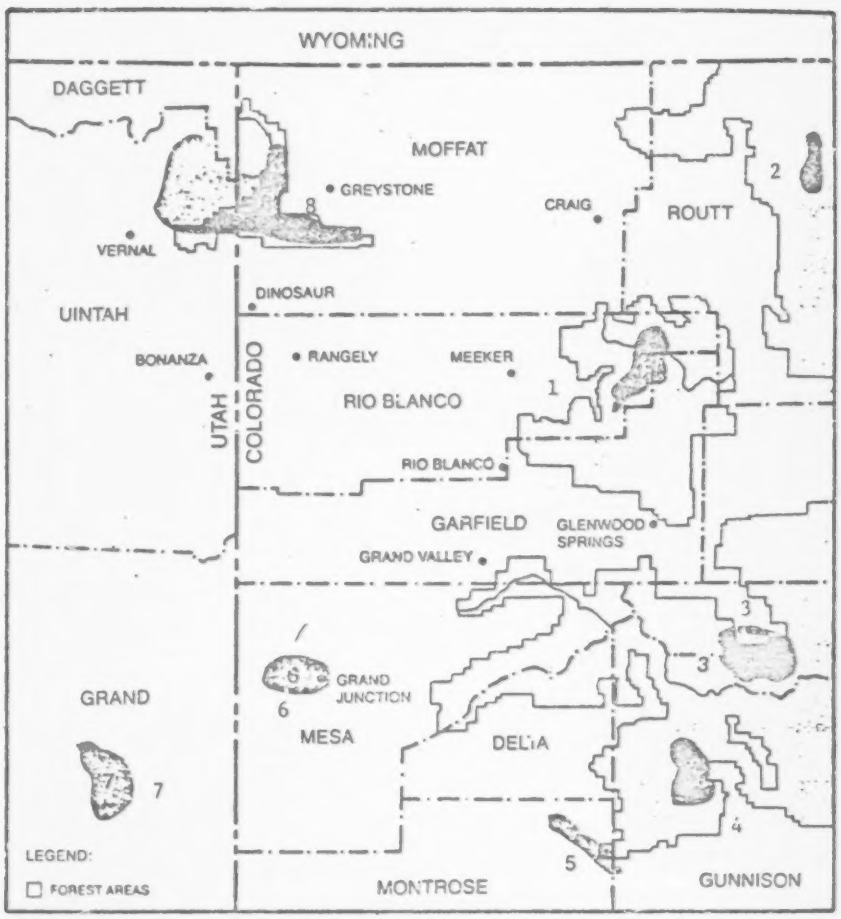
will be overcome and the project potentially completed by the late 1980s. Water from this project would probably be utilized for meeting the requirements of units 3 and 4 at the Craig station and the proposed W. R. Grace Synfuel plant.

In many instances, coal companies acquire ranches in order to obtain water rights and lease the ranch (and thus, the water usage) back to farmers until it is needed for development. As a result of the acquisition of senior water rights by energy companies, there may be a long term decline in agriculture. Inevitably, there will be increased competition for scarce water supplies in Colorado as front range communities continue to grow and the energy industry becomes more established.

Air Quality Standards: While the operation of coal mines generally produces only localized dust control problems, the operation of coal-fired generating plants and synthetic fuels plants may have a significant impact on air quality. These problems could be exacerbated if a major oil shale industry develops in the Piceance Creek area in northwestern Colorado. The cumulative impact of these activities and pollution from secondary population growth and traffic could violate ambient air quality standards. EPA is currently attempting to model western Colorado air patterns to determine what the potential carrying capacity of the region might be.

Craig, Colorado is currently an unclassified air quality district in which particulate emissions exceed Class II standards at certain times of the year. The addition of units 3 and 4 at Craig station and the addition of one or more coal synfuels plants could require the imposition of standards requiring various control technologies. In addition to this potential problem, the Clean Air Act is designed to protect pristine air

Figure 2-4 Designated Class I Areas



AREA DESIGNATIONS

Federal Mandatory Class I Areas: 1, 2, 3, 4, 6
Colorado Class I Areas: 5, 6, 8
Draft Proposed (NPS) Class I Areas: 6, 8

CLASS I AREAS

1. Flat Tops Wilderness
2. Mount Zirkel Wilderness
3. Maroon Bells—Snowmass Wilderness
4. West Elk Wilderness
5. Black Canyon of the Gunnison Monument
6. Colorado National Monument
7. Arches National Park
8. Dinosaur National Monument

SOURCE: Environmental Protection Agency Work Group, *Pollution Control Guidance for Oil Shale Development: Appendices to the Revised Draft*, U.S. Environmental Protection Agency, Cincinnati, Ohio, July 1979, p. D-41.

quality within selected "Class I" regions. There are three Class I regions within a sixty-mile radius of Craig -- Dinosaur National Monument, Flat Tops Wilderness Area, and the Mt. Zirkel Wilderness area. (See Figure 2-4) The cumulative impacts of oil shale development in the Piceance Creek and coal-related development in the Craig area could potentially tax the particulate and SO2 standards set for Class I areas, in turn limiting the amount of new development. In addition to these criteria, EPA has proposed visibility guidelines which can be enforced by either the state or the federal land manager. At present, it is unclear what impact the visibility guidelines will have.

The proposal for a power plant outside of Delta could also have negative air quality impacts since the area already suffers from periodic inversions.

Finally, there are several uncertainties associated with full implementation of the Clean Air Act which could affect synthetic fuels and power plant development. EPA has the authority to set standards for other than currently regulated pollutants and hazardous substances and is required to set a short term NO2 standard. In addition, EPA has the authority to set New Source Performance Standards for emerging technologies such as synthetic fuels production.

Reclamation

There are approximately 77,236 acres on 67 undeveloped federal coal leases in Colorado. Recoverable reserves on these leases are estimated at approximately 1,471 million tons, of which roughly 30% are surface mineable. The majority of these reserves are located in the northwest portion of the

state, in Routt and Moffat Counties (part of the Green River region), Gunnison County (part of the Uinta region), and Jackson County (part of the North Park region). There are also some surface recoverable reserves in the Denver coal region, located in Elbert County in the central portion of the state. The remaining 70% of the recoverable reserves are better suited for recovery by underground mining methods.

Since most of the projected new mine development is expected to occur in underground mines, reclamation problems are not expected to be severe. However, there will be some adverse effects--the severity of which will depend upon site specific characteristics and the reclamation efforts of the mining company. Possible revegetation and reclamation difficulties were identified in a review of the reclamation potential of Colorado coal fields that was prepared for the OTA task force. The following discussion is based on this paper, task force comments, and on the regional coal environmental statements prepared by the BLM.

The Uinta region, which includes the Lower White River, Carbondale, Somerset, Grand Mesa, and Book Cliffs coal fields, has the potential for supporting some of the largest surface mines planned for the state. The overburden depth in future surface mines will vary from 60 to 300 feet with the coal beds varying from 14 to 30 feet in thickness. In some areas, the steeply sloping terrain can both deter and enhance mining capability. In some cases steep slopes will allow ready access to the coal seams, but will also make slope restoration and revegetation extremely difficult, particularly on westward and southward facing slopes. Furthermore, it may be difficult to obtain enough suitable topsoil to cover the rock spoil that is removed during mining.

Similarly, the Carbondale and Somerset fields lie in rough, mountainous areas which can also make reclamation difficult. During snow melt, when the steep slopes are saturated with moisture, topsoil is often lost due to sloughing. Also, the area has many vital streams which must be protected from drainage from the mines. Even intermittent streams are vital to local communities in this area for domestic and agricultural needs.

Reclamation will be difficult to achieve in those mining locations which receive little annual precipitation (9-11"), such as the Cottonwood Creek, Coal Canyon, Cameo and Loma project areas and the Book Cliffs coal field. Opportune conditions for revegetation may occur only every few years in these areas, and will likely require the use of mulches to reduce erosion and retain soil moisture. Also, newly seeded areas will need to be protected from grazing by livestock, game animals, and rodents if the seedlings are to become successfully established.

The Denver coal region faces different potential reclamation problems. The minable coal deposits here are found in seams from 10 to 30 feet thick in an overburden of 200 feet or less. With proper care, the land can be successfully reclaimed. However, extensive areas of the region are underlain with deposits of prairie sands. Unless these sands are mixed with clay loams, revegetation will be difficult and extensive sand dunes could develop as a result of land disturbance during mining.

The climate of the Green River coal region is better suited to successful reclamation than other basins in Colorado. Most of the land to be surface mined in this region supports sagebrush, mountain brush, or aspen types of vegetation. The area is also characterized by rather deep topsoils that can be recovered and redistributed over the replaced overburden.

Revegetation should not be a problem in this area if all restructured slopes are kept at less than a 3:1 slope.

The North Park Region comprises the areas commonly known as Middle Park and North Park of Colorado. Most of the mining in this region to date has been surface mining where the overburden ranges from 20 to 200 feet and coal beds range from 20 to 60 feet in thickness. The land lies in an area with climatic conditions that are favorable for reclamation, but much of the terrain underlain with coal has shallow rocky soils with limited topsoil. Therefore, for successful revegetation, precautions must be taken to provide gentle slopes, with adequate depth of a plant growth medium (18 to 24 inches).

The Raton Mesa Region lies along the lower Rocky Mountains and the foothill areas from Walsenburg south to Raton, New Mexico. Some of the coal is surface mineable but to date most is obtained through underground mines. Much of this land that is underlain with surface mineable coal is steep with rather shallow soils that will be difficult to reclaim unless an effort is made to save all available material that could serve as a plant growth medium. The lower lands lie in a rain shadow that limit annual precipitation to marginal amounts for successful revegetation of mined lands.

The San Juan River Region lies in the south central part of Colorado and includes the Tongue and Durango fields. Some of the coal in this region will be surface mined where overburden averages about 70 feet. Coal beds range from 5 to 40 feet in thickness. Much of the terrain underlain by coal consists of highly dissected plateaus with steepsided valleys that may present reclamation problems unless valley fills provide ample room for

reconstruction of gentle slopes. Climatic conditions generally are favorable for successful revegetation.

In general, reclaimed areas show a decline in two important parameters of vegetation. According to EIS's prepared by the Bureau of Land Management, post reclamation vegetation productivity is reduced by 10-50%, while the diversity of vegetative species is reduced by 50-75% below pre-mining levels. These changes in species composition can reduce the reclaimed area's ability to resist droughts, fire and weedy infestations before natural diversity is restored. Further, these changes can also affect the wildlife populations that the area can support. Large game species, such as deer and elk, are usually displaced, while populations of small mammals, such as rabbits and mice, are favored. In comparison, reclamation for grazing or agriculture is generally more successful, since these uses generally employ low diversity or monocultural crops, which require fairly intensive maintenance in terms of irrigation or soil supplements, such as fertilizer. Thus, the desired post-mining use of land is likely to influence evaluations about the relative success of reclamation practices.

The effects of underground mining are less pronounced than surface mining impacts. The principal surface impacts of underground mining are subsidence and disturbance from surface facilities, haul roads, catchment and settling ponds and storage piles. The major effect is subsidence of the surface, which usually covers an area somewhat larger than the area of the seam being mined. The surface topography after subsidence is dependent on the type of mining technology used and the thickness of the overburden. The surface effects of subsidence can result in fractures, slumping, diversion

of established surface water channels, increased erosion and gullying, and can interfere with surface uses such as grazing and agriculture. Significant potential for underground mine subsidence has been identified in the North Fork Valley and in the Meeker areas and permits for mining operations in those areas could require subsidence monitoring and appropriate mitigation efforts.

Wilderness Values

Colorado has some of the best known units of the National Wilderness Preservation System - the Maroon Bells, the Flat Tops, and the West Elk wilderness areas, for example. These national forest areas were set aside by Congress to be managed to preserve and protect their wild and undisturbed character. There are no federal coal leases in Colorado's existing wilderness areas. Coal development, nevertheless, could have some impacts on the wilderness areas. Coal development, nevertheless, could have some impacts on the wilderness system. The most commonly cited potential impacts are increased use of the areas for wilderness recreation as a result of local population growth associated with expanded coal development. As previously noted, emissions from coal and oil shale development and related facilities could eventually impair air quality related values, including visibility, in several wilderness areas that are designated as mandatory class I federal areas under the Clean Air Act.

While there are no federal coal leases in existing wilderness areas, two BLM wilderness study units overlap portions of existing federal leases. The Demaree Canyon study area includes sections of two leases in Sheridan Enterprises' underground mine complex near Loma. The Little Book Cliffs Wild Horse area wilderness study unit covers portions of three

federal leases.

The Demaree Canyon unit is a high plateau dissected by steep and rugged canyons. The BLM Colorado State Office identified the unit for intensive wilderness study in response to many public comments recommending the area for wilderness status. The August 1979 wilderness inventory description of Demaree Canyon noted that the area was large enough so that the final boundaries of the unit could be drawn to exclude any traces of manmade activities or areas under consideration for energy development if the unit were eventually recommended for wilderness designation. The leased areas in the Demaree Canyon unit would be mined by underground methods with access by a slope or draft entry from an adjacent canyon floor outside the wilderness study area. There would probably be little, if any, surface disturbance on the plateau above the leased reserves.

The Little Book Cliffs wild horse areas wilderness study unit near Palisades, Colorado overlaps portions of three federal leases. One lease is part of GEX-Colorado's Cameo underground mining operation. The other two leases are part of proposed mine plans: one lease is in Mid Continent Limeston's proposed Coal Canyon underground mine; the other is part of the planned Cottonwood Canyon mine, also to be operated by Mid Continent Resources. Like the Demaree Canyon area, the roadless area lies atop a high plateau and the coal would be from entries driven into the steep cliffs below and outside the study areas. There would be little if any surface disturbance in the study area from planned mining activities.

Wildlife Values

Protection of fish and wildlife habitat from the impacts of development on federal leases is a concern of the federal land managers and of state fish and game agencies and citizens groups. Many of western Colorado coal leases are located in areas that support an abundant wildlife population. Hunting and fishing provide recreation and subsistence to local residents and are an important industry in Colorado. Many of the federal lease blocks include significant habitats for deer, elk, and game birds. Many leases are cut or bordered by trout streams.

For these reasons, consideration of wildlife needs and mitigation of adverse impacts on fish and wildlife habitat are significant components of mine design and permitting in Colorado. For example, if natural migration routes for deer and elk would be disrupted by mining, alternative routes are provided and maintained around the mine area. To the extent possible, water supply and habitat areas are protected and maintained to sustain the local wildlife population during mining. In revegetating mined areas, operators can be required to reestablish wildlife habitat and natural diversity of plant species. This requirement sometimes leads to disagreements between the operators and the wildlife managers on one side and the grazing and agricultural users of the public lands on the other hand, over the proper balance in replanting sagebrush, trees, and grasses in reclamation. In some instances, grazing and agricultural users would like to see an increase in the post-mining area allocated to "productive" vegetation (forage) rather than wildlife habitat.

Socioeconomic Impacts

A number of Colorado communities face problems related to rapid rates of growth and population increases associated with energy development. While the opening of a single mine does not generally impose an undue burden on an adjacent community, the cumulative impact of a variety of energy development projects occurring simultaneously can create severe problems in the provision of housing and the fiscal ability of nearby towns to provide services such as sewers, roads, water, schools and hospitals. Other dislocations such as increased crime and alcoholism may arise, which can lead, in turn, to worker unrest and a decline in productivity.

The potential for major socioeconomic problems associated with coal development is evident in Craig, Meeker, and the towns in the North Fork. In Craig, for example, all eight of the proposed new lease tracts in Colorado are within 25 miles of town. The town of Maybel, which is closer to several tracts, currently has a moratorium on new housing starts which could further exacerbate problems in Craig. The construction of two new coal fired units at the Craig generating station, possible construction of a synthetic fuels plant, and construction of major regional reservoirs in the next ten years could produce a major influx of new residents. Craig has been able to handle major population increases which have occurred since 1970 (a doubling of population in Moffat County) with the help of state impact assistance and professional city management. However, the amount of impact assistance money which is actually returned to Craig from federal royalties and state severance taxes is small in comparison to the revenues generated, and this disparity is a sore point with city officials. If Craig is to meet its responsibilities in providing basic services for projected

increases in population (11,200 in 1979 to 20,000 in 1988) the necessary funds will have to be found from higher local taxes, bond initiatives, or from a greater share of revenues generated by mineral royalties and severance taxes, or state or federal energy impact assistance.

The current problems in Craig and Hayden relate more to a decline in population and tax base related to the layoffs at mines and completion of construction of unit 2 at Craig station. At a time when Craig is losing population, voters will be presented with a referendum for a $7 million bond issue to double the current capacity of the water system. Hayden's problems are particularly severe. The town greatly expanded its water system in anticipation of new population growth which did not materialize and now faces the prospect of defaulting on its loan payments in October 1980.

The town of Meeker (1979 population, 1,947) faces the prospect of a much more explosive growth situation if the oil shale industry proceeds according to current plans. Meeker faces the prospect of impacts from oil shale, existing coal and new coal develpment, reservoir, uranium, and oil and gas development. Oil shale poses the largest impacts. For example, total work force estimates for Union, Colony, C-a, and C-b in 1985 range from 2,200 to 3,600 people/facility. Planning for an oil shale work force which fluctuates widely during both construction and operational phases is extremely problematic. A work force of 2,000 could conceivably result in a population influx of over 10,000 people, including families and secondarily induced service population growth. As a result of these circumstances, oil shale impacted towns could experience a 400-600 percent increase in population by 1985, if industry activities proceed as planned.

Rangely, which is already the heart of Colorado's oil and gas development area, will be impacted if the road from federal oil shale tract C-a is constructed. The operation of the Moon Lake Electric mine or leases outside of Rangely, the construction of the power plant in Bonanza, Utah, and the construction of a 32 mile conveyor belt will bring additional workers to Rangely. Moreover, since Rangely is closer to the power plant site than Vernal, Utah, most of the workers will probably reside in Rangely. As a result, Rangely will bear the costs of accommodating workers without the benefit of tax revenues from the power plant.

Two other coal related projects could have major impacts on adjacent communities. The opening of the new ARCO Mt. Gunnison mine will bring in approximately 465 new employees by 1991 with a cumulative impact of 2,100 people. Most of these people will locate in small North Fork communities such as Paonia, Hotchkiss, and Crawford which could experience a doubling of population. Lack of housing and community facilities and overcrowding of roads could be the major impacts. The construction of a 400 MW Colorado-Ute power plant in Delta and accompanying hydroelectric dam in Austin could bring in another two thousand plus workers during construction and have a major impact on Delta.

Many areas in Colorado have developed Local Impact Teams composed of local, state and federal officials, industry, and public interest groups which meet periodically to address impact issues and prepare and prioritize requests for state impact assistance funding. The aim of the Local Impact Teams is to develop coordinated public/private responses to identified impact problems. In addition, many energy developers in Colorado have contributed substantially in upgrading of services and facilities, assisted in the provision of housing for workers, pre-paid severance taxes, and in a few cases, offered training programs for local residents.

CHAPTER 3

ANALYSIS OF UNDEVELOPED FEDERAL COAL LEASES IN COLORADO

Background

Section 10 of the Federal Coal Leasing Amendment Act of 1976, Public Law 94-377, requires OTA to evaluate the more than 500 existing coal leases and 172 pending preference right lease applications (PRLAs) on Federal lands. Specifically, OTA was requested to:

1. Analyze all mining activities on federal leases;
2. Determine the present and potential value of the leases;
3. Estimate federal revenues from the leases; and
4. Examine the feasibility of using deep mining technology in leased areas.

To accomplish these tasks, OTA must determine (a) which of the existing leases and PRLAs will be mined, (b) how they will be mined, and (c) how much coal will be produced and sold. As a first step, OTA must identify the leases that can support viable mining operations in the next decade. To do this, OTA must analyze information on the ownership, amount, and quality of the coal reserves, as well as data on geo-engineering, market, environmental and transportation conditions in the lease area.

For those leases that are part of an existing or planned mining operation, OTA technical contractors have evaluated the mining plans on file with the U.S. Geological Survey and the Office of Surface Mining to obtain the best current information on both the production potential of the leases

and the development intentions of the lessee. OTA will use this information from mine plans in evaluating these "developed" leases. The results of the mine plan analysis will be summarized in OTA's final report on Federal coal leases.

According to the Department of Interior, over half of the existing leases are not covered by approved or pending mine plans. Thus, for these undeveloped leases, there is no readily available compilation of the lease characteristics of the lessee's production plans. Evaluating the development potential of these leases is one of the most difficult tasks OTA faces in completing its mandated study. OTA decided to convene a series of state task forces to assist in assessing the undeveloped leases and in identifying the major coal development issues in each state. Task forces were held in Colorado, Utah, New Mexico, Oklahoma and Wyoming. All task forces followed the same guidelines.

The Colorado Task Force was held in Denver on September 22 to 24, 1980. The participants included representatives from state and federal agencies, coal companies and environmental groups, as well as several OTA technical consultants. A list of participants is included in the appendix. The task force rated the development prospects of 69 federal leases in Colorado. This section summarizes the results of the task force and OTA's evaluation of the undeveloped lease blocks in Colorado.

Status of Existing Federal Coal Leases in Colorado

As of September 30, 1980, Colorado has 127 outstanding federal coal leases covering more than 126,000 acres and encompassing more than 2.2 billion tons of recoverable coal reserves. (See Tables 3-1 and 3-2).

TABLE 3-1

COLORADO LEASES AND PRLAS

SEPTEMBER 30, 1980

	Number of Leases	Number of PRLA's
Denver Raton Region		
Las Animas County	2	6
Elbert County	4	9
Arapahoe County	0	1
Adams County	0	2
El Paso County	0	2
Regional Subtotal	6	20
Green River-Hams Fork Region		
Jackson County	7	1
Moffat County	11	3
Routt County	24	1
Regional Subtotal	40	5
San Juan Region		
La Plata County	1	0
Montrose County	4	1
Ouray County	2	1
Regional Subtotal	7	2
Uinta Region		
Delta County	8	0
Garfield County	7	3
Gunnison County	28	0
Mesa County	8	0
Pitkin County	6	0
Rio Blanco County	14	7
Regional Subtotal	71	10
TOTAL	126	37

TABLE 3-2

LEASE ACREAGE BY COUNTY AND DEVELOPMENT STATUS,

RECOVERABLE RESERVES IN UNDEVELOPED LEASES

COUNTY	UNDEVELOPED LEASE ACREAGE	DEVELOPED LEASE ACREAGE	RECOVERABLE RESERVES IN UNDEVELOPED LEASES (million tons)
Delta	394.99	5,259.89	7.98
Elbert	2,683.68	0.00	48.74
Garfield	15,049.58	0.00	124.18
Gunnison	14,135.84	4,831.32	289.95
Jackson	4,239.67		88.4
LaPlata	0.00	160	0.0
Las Animas	1,001.92	0.00	17.73
Mesa	0.00	10,504.14	0.00
Moffat	6,317.87	8,285.46	290.17
Montrose	6,520.25	0.00	75.5
Ouray	3,561.93	0.00	7.5
Pitkin	5,379.59	4,036.9	59.00
Rio Blanco	11,978.22	3,262.23	420.24
Routt	5.031.09	13,703.24	46.05
Totals	76,494.63	50,043.18	1,475.44

Fifty-four of the existing leases are part of operations with approved mining plans. These active leases include two production maintenance leases issued in 1980. Mining plans covering an additional 21 federal leases have been filed for approval with the Office of Surface Mining and the U. S. Geological Survey. For the remaining 52 leases, no mining plans have been submitted. There are also 37 preference right lease applications pending approval in Colorado. These PRLA's cover a total of 82,923 acres and are estimated to contain over a billion tons of recoverable coal reserves. The Department of the Interior has announced that it will process all PRLA's by 1984.

In selecting the leases to be evaluated by the Colorado Task Force, OTA reviewed the mine plan status of all federal leases in Colorado with the Office of Surface Mining and the U. S. Geological Survey. OTA classified as "developed" 58 leases that were included in active mines with approved plans or were part of apparently complete mining plans under active review of OSM as of July 1, 1980. These mine plans will be reviewed by OTA technical contractors as part of OTA's analysis and will be summarized in the final report on the leasing assessment.* Leases in incomplete or inactive mine plans or those leases with no plan on file were classified as undeveloped leases to be analyzed by the task force. OTA identified 69 undeveloped leases. Some leases with mine plans currently on file with OSM were included in the undeveloped category because: a.) the plans were incomplete and did not have enough information for analysis by OTA's contractors; b.) the plans had been submitted in 1978 or earlier for inclusion in regional coal environmental statements and had not been updated by the lessee since then; or c.) the plan was submitted after July 1, 1980.

*Dames & Moore, Analysis of Federal Coal Leases in Mine Plans in Colorado, New Mexico and Utah, final draft report December 1980. Available through National Technical Information Service.

Evaluation of the Development Prospects for Federal Leases

A prospective developer's first concern in evaluating a potential mine property is whether or not the tract has sufficient recoverable reserves with the required coal quality characteristics to sustain a viable mining operation. After determining if there is an adequate reserves base, the developer will consider other factors such as transportation, environmental and community conditions that affect the costs, timing, and permitting requirements for opening a mine. Those leases which, after this review, are found to have few, if any, legal, engineering, environmental or other constraints on development and which alone or in combination with other lands controlled by the same lessee have sufficient reserves to sustain a viable mine can be said to have favorable development prospects and would then be given a more exhaustive examination as a potential investment.

OTA's process for reviewing federal leases without mine plans approximates the approach that a prudent developer would use in evaluating a property. The first step in the evaluation process is to compare the reserves characteristics of the undeveloped leases with a profile of a viable new mining property to identify those leases that meet the minimum mine design requirements. Viable mine profiles for average new mines were developed for each western coal basin with Federal leases. All adjoining leases held by the same lessee were treated as a single block in this initial screening process. In the second step in the evaluation process, other factors that affect the tract's development prospects are considered. These other factors include the potential markets, geographic location, status of adjacent lands, surface resource value, transportation availability, community infrastructure, and environmental impacts. The

results of this review are used in combination with the initial screening process to divide existing undeveloped leases into three categories:

Leases with Favorable Development Prospects - The lease or lease block has favorable development characteristics overall; the lease(s) meet the threshhold criteria for a viable mining property; there are no major* technical or permitting problems or uncertainties associated with the lease development.

Leases with Uncertain Development Prospects - The lease or lease block has generally uncertain development prospects because development is contingent on conditions that are independent of the characteristics of the property or additional information or analysis is required to evaluate development prospects.

Leases with Unfavorable Development Prospects - The lease or lease block has generally unfavorable or difficult development prospects because a) it does not meet the threshhold criteria for a viable mining property and/or b) there are major* technical or permitting problems or uncertainties associated with lease development.

The state task forces actively participated in this two-step evaluation process. The task forces reviewed and, where necessary, modified the profiles used in the initial screening process so that the criteria generally reflect conditions for each coal basin. The task force also reviewed initial screening results to assure that the information on coal reserves, quality and ownership information is reasonably correct. The task force members drew on their experience and knowledge of local conditions to assess the influence of other factors on the tract's development prospects. Tract characteristics were appraised and a judgment was made about whether the tract would be in production under normal operating conditions by 1986 or 1991 diligence dates. The information and opinions supplied by the task force are reviewed by OTA and, as required, supplemented with other information to determine the development potential of each block.

*A major technical or permitting problem or uncertainty is one that is so substantial that a prudent mining firm would not make a significant commitment of resources to development under existing conditions.

OTA Undeveloped Lease Blocks

For OTA's analysis, all adjoining undeveloped federal leases held by the same lessee and forming a compact and contiguous minable unit were combined into a single lease block so that each tract would approximate a potential mining unit. Federal coal leases in approved mine plans, PRLA's, unleased federal coal lands, state coal leases and private coal lands were not included in the lease blocks. However, where federal leases were known to be connected by intervening federal leases, PRLA's, or state or fee land controlled by the same lessee, they were treated as single blocks and subdivided for identification purposes.

Mining units are generally designed to consist of sufficiently compact and contiguous areas to allow for economy of operation and an orderly sequence of mining. Leases in the tract should form an unbroken and continuous unit so that operations can efficiently follow the seams to be mined. Intervening areas not under the control of the operator impose design restrictions and reduce access to and recoverability of coal in the leased area in order to leave the required buffer zone surrounding the unleased area. For this reason, developers will usually seek to obtain the rights to all the properties within the proposed mining area.

The 69 undeveloped leases were divided into the 45 lease blocks shown in table 3-3. (A more extensive list of the leases in each block and maps showing the locations of all leases are included in the appendix). Two of the lease blocks (31 and 38) consist of several non-contiguous units that are joined by fee lands or federal PRLAs held by the lessee and thus form a

TABLE 3-3

OTA
COLORADO UNDEVELOPED LEASE BLOCKS
September 30, 1980

Block Number	Lessee	Number of Leases	Acres	County
1	AMCA Coal Leasing	1	250.41	Routt
2	Franklin Real Estate	1	634.42	Routt
3	Fern James, Estate	1	40.10	Moffat
4*	Prospero Lombardi	1	80.00	Routt
5	W.R. Grace & Company	1	3863.00	Moffat
6	Peabody Coal Company	1	1320.00	Routt
7	Peabody Coal Company	1	160.00	Routt
8	Peabody Coal Company	1	2280.00	Routt
9	Ruby Construction Company	1	146.26	Routt
10	Sheridan Enterprise	1	160.00	Routt
11	Utah International	1	159.35	Moffat
12	Consolidation Coal Company	2	4578.69	Rio Blanco
13	Consolidation Coal Company	1	225.86	Rio Blanco
14	Consolidation Coal Company	1	1096.73	Rio Blanco
15	Consoldation Coal Company	2	1331.50	Rio Blanco
16	Utah International	1	2255.22	Moffat
17*	Western Fuels Association	1	2557.22	Rio Blanco
18*	Western Fuels Association	1	513.00	Rio Blanco
19	Russell Chapman & Paul Riebold	1	1675.22	Rio Blanco
20	Gulf Oil Company	1	280.00	Delta
21*	ARCO	3	7419.61	Gunnison
22*	Anchor Coal Company	1	280.00	Gunnison
23	U.S. Steel Corporation	1	1092.33	Gunnison
24	U.S. Steel Corporation	1	560.00	Gunnison
25	U.S. Steel Corporation	1	213.99	Gunnison
26	Thompson Creek Coal	1	120.00	Gunnison
27**	Garland Coal	1	497.64	Pitkin
28	U.S. Steel Corporation	8	3469.13	Gunnison
29*	Anschutz Corporation	2	4881.95	Pitkin
30	AMCA Coal Leasing	1	120.00	Jackson
31 A,D	Kemmerer Coal & Consolidation	1	560.00	Jackson
31 C	Kemmerer Coal & Consolidation	1	1680.00	Jackson
31 D	Kemmerer Coal & Consolidation	1	1706.92	Jackson
32	Wyoming Fuels	1	172.75	Jackson
33	Welch & Wiggins	1	120.25	Garfield
34*	Sheridan Enterprises	6	14,929.33	Garfield
35*	Belden Enterprises	1	41.29	Delta
36	Utah International	1	173.70	Delta
37*	Harry & Opal Weaver	1	80.00	Gunnison
38 A	Kemmerer Coal Company	6	10,002.72	Gunnison/ Montrose
38 B	Kemmerer Coal Company	1	2320.00	Ouray
39	Albert Martinez	1	40.00	Las Animas
40	CF&I Steel Company	1	961.92	Las Animas
41	Peabody Coal Company	3	1923.68	Elbert
42	Peabody Coal Company	1	760.00	Elbert

*mine plan on file at U.S. Department of the Interior, Office of Surface Mining, as of September 30, 1980.

**relinquishment pending

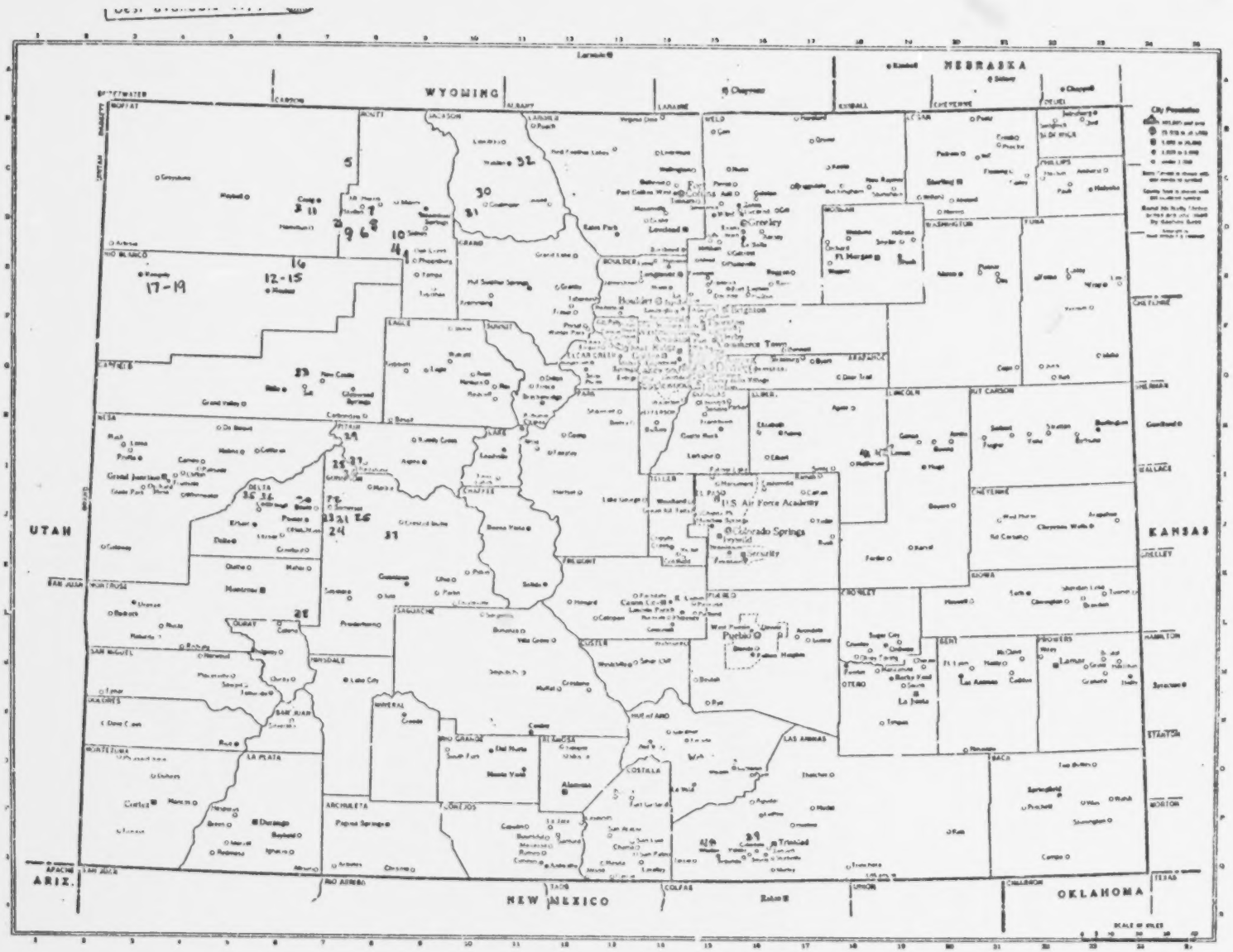


FIGURE 3-1

Colorado: Block numbers shown in approximate location

single mining unit. The blocks were subdivided so that they could be more easily identified in the analysis. The lease blocks consist of from 1 to 8 leases and range in size from 40 acres to 14,929 acres. There are 37 single lease blocks, including the noncontiguous subdivided blocks. One block (#27) was dropped from further consideration by the task force because it is being relinquished by the lessee and will not be developed. For this reason, it was rated as having unfavorable development potential.

Development of Threshhold Criteria for Viable New Coal Mine Properties in Colorado

OTA developed a set of technical criteria or "screens" that describe the minimum or threshhold requirements for a typical new coal mine for each coal field in Colorado with federal leases. Typical new mine profiles for the period 1980-1990 were developed for both surface and underground mines. An alternative small mine profile was also developed. These screens use geological, ownership and other lease-specific information in approximating the initial evaluation process that a prospective developer might use in determining whether a tract is a favorable prospect that merits a more exhaustive examination. The screens can be summarized as follows:

1. Logical mining unit. Is the lease block compact and contiguous and under single ownership to allow for orderly development as a mining unit?

2. Coal reserves. Are the recoverable coal reserves within the lease block sufficient to support a competitively sized new mining operation?

3. Coal quality. Do the coal reserves meet minimum Btu, sulfur, and ash quality standards for the expected end use (e.g., steam coal, industrial use, synthetic fuels)?

4. Geological characteristics. Do the geological and topographical conditions of the coal reserve--such as depth of overburden, seam thickness and dip-- permit efficient mine design and economic coal recovery.

5. Ownership. Does the lessee have the financial capability or mining expertise to develop the lease block?

The threshhold criteria for viable new mines in Colorado are shown in Table 3-4. A more extensive description of the screens is included in the appendix. OTA used the screening process to make a preliminary classification of the lease blocks for review by the task force. The screens are based on profiles of typical Colorado surface and underground mines prepared for OTA by the Colorado School of Mines Research Institute (CSMRI)* and on consultations with USGS and Colorado state officials, with industry sources and with OTA project advisory panel members. The task force participants reviewed and approved the screening criteria and proposed alternative coal quality criteria for the North Park and Coal Basin fields. In applying the screens, OTA used information on the leases from the Department of Interior's automated coal lease data system (ACLDS), from regional coal environmental statements and other published sources, as well as information provided by federal and state government agencies and OTA contractors.

Modifications in the Preliminary Screening Process

The screens used in the initial evaluations were developed for use as a general tool in assessing the undeveloped leases in Colorado. The threshhold criteria for new mines were selected to be representative of new mines opening in Colorado over the next decade. Several of the screens were modified to reflect task force and reviewer suggestions for local variations in the mine profiles. The minimum heat value was set at 9000 BTU/lb for marketable coals in the North Park Field. Coal produced in the North Park area competes with similar Wyoming coals and is shipped by rail from Walden

*The profiles are described in an OTA Working Paper, Criteria for Determining Viable Mining Properties on Existing Federal Coal Leases in the Western United States, final report, March 1980, prepared by the Colorado School of Mines Research Institute, Golden, Colorado.

TABLE 3-4

OTA SCREENING PROCESS FOR UNDEVELOPED FEDERAL COAL LEASES IN COLORADO

REVISED THRESHHOLD CRITERIA FOR VIABLE NEW MINES

CASE 1 - LARGE SURFACE MINE

Large surface mine producing coal for electric utility use.

Mine size: 500,000 tons/year
Mine life: 30 years

Reserves: 15 million tons of surface recoverable reserves

Quality:

- o 10,000 BTU/lb. or more (for North Park Field only, BTU/lb of 9000 or more)
- o 0.7% sulfur or less
- o 12% ash or less

Seam Thickness: 6' or more

Overburden: 250 feet or less

Seam dip: over 15° presents difficulty, but Colorado surface mines operate on seams up to 60° dip.

Initial Capital Investment: $5-$10 million

CASE 2 - LARGE UNDERGROUND MINE

Large underground mine producing coal for electric utility, metallurgical, or industrial use.

Mine size: 500,000 tons/year
Mine life: 30 yars

Reserves: 15 million tons of underground recoverable reserves

Coal Quality:

- o at least 12,000 BTU/lb.
- o 0.7% sulfur or less (For Coal Basin field only 1.0% sulfur or less.)
- o 10% ash or las

Seam thickness: 6'

Overburden: 250 feet or more

Seam dip: over 8° is difficult, however Colorado underground mines operate in seams up to 30° dip.

Initial Capital investment $25-$30 million

CASE 3 - SMALL MINE ALTERNATIVE

Small underground or surface mine producing coal for utility, spot market, industrial or local use.

Mine size: up to 50,000 tons/year
Mine life: 20 years

Reserves: 1 million tons of recoverable reserves

Coal Quality:

- o at least 10,000 BTU/lb.
- o 1.0% sulfur or less
- o 10% ash or less

Seam thickness: 3' or more

Overburden: to 100 feet for surface mines

Seam dip: Not a limiting factor for small mines.

Initial Capital Investment: $1-$2 million.

through Wyoming to markets in Colorado and the mid-west. The acceptable sulfur content was set at 1 percent or less for high BTU and metallurgical grade coals in the Coal Basin (Carbondale) field. Seam dip or pitch, which can be a significant consideration in mine design and equipment decisions, was not found to be a decisive factor in evaluating Colorado lease blocks since existing mines operate in a wide range of conditions. The mineable dips for Colorado mines were set at up to 60 degrees for surface mines and up to 30 degrees for underground mines to reflect the limits of existing operations. For small mines, seam dip is not a limiting factor, some small underground mines have operated in beds that pitch as steeply as 85 degrees.

Results of the Initial Lease Evaluations

OTA used the preliminary screening process to evaluate the 68 leases in the 44 undeveloped lease blocks in Colorado. One block (#27) was not evaluated because it is in the process of being relinquished. The blocks were compared with the profiles for typical new large mines producing half a million tons annually. Table 3-5 shows the results of OTA's initial evaluations.

Eleven blocks met all of the criteria; 32 failed to pass one or more of the screens. The results discussed in this section refer only to the threshold requirements for large mines--case 1 and case 2 shown in Table 3-4. Small lease blocks of less than 400 acres that did not satisfy the requirements for large mines were also screened using an alternative small mine model (case 3 in Table 3-4). The screening results for small mines are described in the next section.

TABLE 3-5 SUMMARY OF ANALYSIS OF UNDEVELOPED FEDERAL COAL LEASES IN COLORADO - OCTOBER 1980

Block Number	Lessee	# of Leases	Acres	County	Type of Reserve	Passes Mining Unit Screen?	Passes Reserves Screen?	Passes Coal Quality Screens?	Passes All Geologic Screens?	Passes Ownership/Investment Screen?	Passes All Screens	Task Force Classification	Task Force Evaluation of Development Prospects 1986	1991
1	AMCA Coal Leasing	1	250.41	Routt	U&S	Yes	No	Yes	Yes	Yes	No	+	?	?
2	Franklin Real Estate (Grace)	1	634.42	Routt	U	Yes	No	Yes	Yes	Yes	No	-	-	?
3	Fern James, Est.	1	40.10	Moffat	U	Yes	No	Yes	Yes	No	No	-	-	-
4	Prosper Lombardi	1	80.00	Routt	U	Yes	No	Yes	Yes	Yes	No	-	-	-
5	W.R. Grace	1	3863.00	Moffat	U&S	Yes	Yes	Yes	Yes	Yes	Yes	+	-	?
6	Peabody Coal Company	1	1320.00	Routt	S	Yes	No	Yes	Yes	Yes	No	+	+	+
7	Peabody Coal Company	1	160.00	Routt	U	Yes	No	Yes	Yes	Yes	No	-	-	-
8	Peabody Coal Company	1	2280.00	Routt	U	No	Yes	Yes	Yes	Yes	No	+	-	+
9	Ruby Construction Co.	1	146.26	Routt	S&U	Yes	No	Yes	Yes	Yes	No	+	-	?
10	Sheridan Enterprises	1	160.00	Routt	U	Yes	No	Yes	Yes	Yes	No	-	-	-
11	Utah International	1	159.55	Moffat	U	Yes	No	Yes	Yes	Yes	No	-	-	-
12	Consolidation Coal Co.	2	4578.69	Rio Blanco	U&S	Yes	Yes	Yes	Yes	Yes	Yes	+	-	?
13	Consolidation Coal Co.	1	225.86	Rio Blanco	U	Yes	No	Yes	Yes	Yes	No	+	-	?
14	Consolidation Coal Co.	1	1096.73	Rio Blanco	U	Yes	Yes	Yes	Yes	Yes	Yes	+	-	?
15	Consolidation Coal Co.	2	1331.50	Rio Blanco	U	Yes	Yes	Yes	Yes	Yes	Yes	+	-	?
16	Utah International	1	2255.22	Moffat	S	Yes	Yes	Yes	Yes	Yes	Yes	+	-	?
17	Western Fuels	1	2557.22	Rio Blanco	U	Yes	Yes	No	Yes	Yes	No	+	?	+
18	Western Fuels	1	513.00	Rio Blanco	U	Yes	Yes	No	Yes	Yes	No	+	?	+
19	Russell Chapman & Paul Riebold	1	1675.22	Rio Blanco	U	Yes	Yes	No	Yes	No	No	+	-	?
20	Gulf Oil Company	1	280.00	Delta	U	Yes	No	Yes	Yes	Yes	No	-	-	-
21	ARCO	3	7419.61	Gunnison	U	Yes	Yes	Yes	Yes	Yes	Yes	+	+	+
22	Anchor Coal Company	1	280.00	Gunnison	U	Yes	Yes	Yes	Yes	Yes	Yes	+	+	+
23	U.S. Steel Corporation	1	1092.33	Gunnison	U&S	Yes	No	Yes	Yes	Yes	No	+	-	?
24	U.S. Steel Corporation	1	560.00	Gunnison	U&S	Yes	No	Yes	Yes	Yes	No	+	-	?
25	U.S. Steel Corporation	1	213.99	Gunnison	U	Yes	No	Yes	Yes	Yes	No	+	-	?
26	Thompson Creek Coal	1	120.00	Gunnison	U	Yes	No	Yes	Yes	Yes	No	+	-	?
27	Garland Coal	1	497.64	Pitkin						Relinquishing Lease				
28	U.S. Steel Corporation	8	3469.13	Gunnison	U	Yes	Yes	Yes	Yes	Yes	Yes	+	-	+
29	Anschutz Corporation	2	4881.95	Pitkin	U	Yes	Yes	Yes	Yes	Yes	Yes	+	?	+
30	AMCA Coal Leasing	1	120.00	Jackson	U&S	Yes	No	No	Yes	Yes	No	-	-	-
31A&B	Kemmerer Coal/Consol	1	560.00	Jackson	U&S	No	No	Yes	Yes	Yes	No	+	-	?
31C	Kemmerer Coal/Consol	1	1680.00	Jackson	U&S	Yes	No	Yes	Yes	Yes	No	+	-	?
31D	Kemmerer Coal/Consol	1	1706.92	Jackson	U&S	Yes	Yes	Yes	Yes	Yes	Yes	+	-	?

SUMMARY OF ANALYSIS OF UNDEVELOPED FEDERAL COAL LEASES IN COLORADO - OCTOBER 1980 (continued)

Block Number	Lessee	# of Leases	Acres	County	Type of Reserve	Passes Mining Unit Screen?	Passes Reserves Screen?	Passes Coal Quality Screens?	Passes All Geologic Screens?	Passes Ownership/Investment Screen?	Passes All Screens	Task Force Classification	Task Force Evaluation of Development Prospects 1986	1991
32	Wyoming Fuels	1	172.75	Jackson	U	No	No	Yes	Yes	Yes	No	-	-	-
33	Welch & Wiggins	1	120.25	Garfield	U	No	No	No	Yes	No	No	-	-	-
34	Sheridan Enterprises	6	18929.33	Garfield	U	Yes	Yes	Yes	Yes	Yes	Yes	+	?	+
35	Belden Enterprises	1	41.29	Delta	U	Yes	No	Yes	Yes	Yes	No	+	+	+
36	Utah International	1	173.70	Delta	U	Yes	No	Yes	Yes	Yes	No	-	-	-
37	Weaver	1	80.00	Gunnison	U	Yes	No	Yes	Yes	Yes	No	+	+	-
38A	Kemmerer Coal	6	10,002.72	Gunnison/ Montrose	U	Yes	Yes	No	Yes	Yes	No	+	-	-
38B	Kemmerer Coal	1	2320.00	Ouray	U	Yes	No	No	Yes	Yes	No	+	-	-
39	Martinez	1	80.00	Las Animas	U	Yes	No	Yes	Yes	No	No	-	-	-
40	CF&I Steel Co.	1	961.92	Las Animas	U	No	Yes	Yes	Yes	Yes	No	+	-	-
41	Peabody Coal Co.	3	1923.68	Elbert	S	Yes	Yes	No	Yes	Yes	No	+	-	?
42	Peabody Coal Co.	1	760.00	Elbert	S	Yes	No	No	Yes	Yes	No	+	-	?

The 11 lease blocks that met all the criteria for viable new mines contain a total of 28 leases covering over 45,000 acres and more than 1.1 billion tons of recoverable coal reserves (800 million tons of recoverable underground reserves and about 336 million tons of recoverable surface mineable reserves). The blocks account for 79% of the undeveloped federal lease reserves in Colorado.

The 32 lease blocks that did not pass the preliminary screens have a total of 40 leases covering over 20,000 acres, and contain an estimated 108 million tons of recoverable strip reserves and 196 million tons of recoverable underground reserves. These lease blocks contain about 21% of the recoverable reserves on undeveloped federal leases in Colorado. Five of these lease blocks failed more than one screen.

Twenty-six lease blocks (26 leases) failed because they did not have enough recoverable reserves to support a viable new large mine (15 million tons). Only the existing federal lease reserves were included in the lease blocks at this stage in the evaluation. The availability of additional reserves from federal PRLA's, new federal leases, or from state or private coal lands was considered later in the analysis. Nineteen lease blocks failed only the reserves requirements so that the availability of more coal reserves could make them more attractive to potential developers.

Nine lease blocks (16 leases) did not meet the minimum coal quality characteristics for new mines to serve electric utilities or industrial needs. Of these nine blocks, four blocks (11 leases) failed only the coal quality screens (17, 18, 38A, and 41).

Four were single lease blocks consisting of non-contiguous parcels of land that did meet the requirements for a single, continuous mineable unit (18, 31A&B, 33, and 40).

Four blocks did not pass the ownership or investment screen. These lessees do not have either the mining experience or the financial resources to develop a mine (3, 19, 33 and 39). (Information on the lessee's financial and technical capabilities was obtained from an OTA study of the ownership of federal leases and PRLA's which was based on lease files, public documents, trade journals and financial publications, and lessee interviews.)*

Failure to pass the initial screens, however, does not necessarily mean that a lease block cannot be developed. For example, a block with unsufficient reserves to support a large mine might sustain a small mining operation or might be combined with adjacent federal or non-federal lands to form a larger, more viable mining unit. Alternative small mine models were developed for screening small lands. Coal reserves with low heat values (BTU/lb), or with sulfur or ash contents that are too high for steam coal use could be suitable for on or near site power generating or local domestic or industrial uses. These alternative development possibilities are limited, however, and were not included in the initial screening. OTA incorporated information on alternative development possibilities provided by the task force and other sources later in the evaluation process.

*The results of this study are contained in an OTA Technical Memorandum, "Patterns and Trends in Federal Coal Lease Ownership 1950-1980", March 1981.

Alternative Screening Process for Small Mines

Colorado has many active small mines. Of the 74 producing mines in Colorado in 1979, more than one-third had an annual output of less than 100,000 tons. Most, but not all, of the new mines to be developed in Colorado over the next decade are expected to be large mines producing over one-half million tons annually. This expectation is reflected in OTA's preliminary screening. However, because of the large number of active small mines in Colorado, OTA developed a set of threshhold criterial for a typical new small mining operations. This alternative screening process for small mines was used to evaluate lease blocks of less than 400 acres that were separated geographically from other tracts held by the same lessee and that did not meet the criteria for new large surface or underground mines. The small mine criteria are shown as Case 3 in Table 3-4. The results of the alternative screening process for small mines are shown in Table 3-6.

Fourteen single-lease blocks were tested using the small mine criteria. The blocks ranged in size from 40 to 380 acres. The small tracts total 2,024 acres and contain about 26 million tons of recoverable coal reserves, 2 percent of the total federal lease reserves and 1.8 percent of the recoverable reserves on undeveloped leases in Colorado. Many of them had produced coal in the past. Two are currently inactive mines that are being reopened (#35 and #37). One tract is a 40 acre competitive lease that was issued in 1978 to support a proposed small mine for local markets (#4).

Of the 14 tracts screened, seven met all of the criteria for a new small mine (Nos. 1, 9, 20, 26, 32 and 34). Seven failed to meet one or more of the criteria (Nos. 3, 4, 10, 30, 33, 37 and 39). One tract failed all of the criteria (#33). Six of the tracts did not have enough federal lease

TABLE 3-6

RESULTS OF SCREENING USING ALTERNATIVE CRITERIA FOR SMALL MINES

Block Number	Lessee	Acres	Types of Reserves	Contiguous Mining Unit?	Passes Reserves Screen?	Passes Coal Quality Screens?	Passes All Geologic Screens?	Passes Investment/Mining Experience Screen?	Passes All Small Mine Screens?
1	AMCA Coal Leasing	250.41	U&S	Yes	Yes	Yes	Yes	Yes	Yes
3	Fern James, Estate	80.10	U	Yes	No	Yes	Yes	No	No
4	Prosper Lombardi	80.00	U	Yes	No	Yes	Yes	Yes	No
9	Ruby Construction Co.	146.26	U&S	Yes	Yes	Yes	Yes	Yes	Yes
10	Sheridan Enterprises	160.00	U	Yes	No	No	Yes	Yes	No
20	Gulf Oil Company	280.00	U	Yes	Yes	Yes	Yes	Yes	Yes
26	Thompson Creek Coal	120.00	U	Yes	Yes	Yes	Yes	Yes	Yes
30	AMCA Coal Leasing	120.00	U&S	Yes	Yes	No	Yes	Yes	No
32	Wyoming Fuels	172.75	U	Yes	Yes	Yes	Yes	Yes	Yes
33	Welch & Wiggins	120.25	U	No	No	No	No	No	No
35	Belden Enterprises	81.29	U	Yes	Yes	Yes	Yes	Yes	Yes
36	Utah International	173.70	U	Yes	Yes	Yes	Yes	Yes	Yes
37	Harry & Opal Weaver	80.00	U	Yes	No	Yes	Yes	No	No
39	Albert Martinez	40.00	U	Yes	No	Yes	Yes	Yes	No

reserves to sustain a mine for the estimated 20 years required to recover the initial investment (Nos. 3, 4, 10, 33, 37 and 39).

Two blocks did not meet the reserves criteria or the minimum coal quality characterists (Nos. 10 and 33). Three tracts did not pass the ownership screen. Two of the tracts are held by individuals with no mining experience (Nos. 3 and 39); one is held by the estate of the original lessee and surface owner--a rancher who obtained the lease to control any development on the property (No. 3).

The small mine tracts that meet all the threshold criteria for a small 50,000 ton/year mine represent about 1.5% or 21.6 million tons of recoverable reserves on undeveloped federal leases in Colorado.

Task Force Evaluations of Property Characteristics

The Colorado task force members were first asked to determine whether each block was a mineable property of the type likely to be developed in the next decade. The blocks were classified as either favorable or unfavorable mine properties. (This assessment is similar to preliminary screening.) Thirty one blocks were rated as favorable new mine properties and thirteen were classified as unfavorable properties. Task force classifications of lease block property characteristics is shown on Table 3-5. The task force rated 31 lease blocks as favorable prospects for development. These blocks encompass a total of 55 leases covering 74,796 acres, and contain an estimated 1.0 million tons of recoverable surface reserves and 44 million tons of recoverable underground reserves. Eleven of 31 favorable mine properties met the threshhold criteria for new mines. Twenty of these did not meet one or more of the OTA threshhold screens but the task force rated

these as favorable for a variety of reasons. In several instances, poor coal quality, geologic and reserves characteristics were not controlling--other considerations made some otherwise unfavorable tracts more favorable.

Six tracts that would not support independent mining operations were rated as favorable because they could be developed either as part of an expansion or shift in production at an existing mine, or as a new operation sharing the lessee's plan and facilities nearby. (No's. 6, 8, 13, 23, 24, 25).

Four tracts were deemed favorable as potential small mines (Nos. 1, 9, 35, 37). The task force identified the need for small mines to supply local needs as a reason for potential viability of one or more small mines. Existing large operations were reported to be unwilling or unable to meet the needs of local consumers for small purchases of coal for domestic heating use.

Ten blocks did not meet the coal quality criteria for new mines for steam or industrial coal production but were rated as favorable by the task force because of special circumstances. One circumstance cited involved development of the tract for on-site or near site use of the coal, such as electric power or synfuel plants, thus making the coal quality characteristics less significant relative to the transportation requirements for coal of similar or higher quality from other sources within the state (Nos. 17, 18, 19, 41, 42). The existence of large tracts of uncommitted reserves that could be competitive with reserves outside of Colorado was also a circumstance that outweighed unfavorable coal characteristics (Nos. 31 A&B, 31 C, 31 D, 38 A, 38 B).

The task force rated 13 lease blocks with 13 leases as unfavorable mine

properties. All of these blocks did not meet the threshold requirements for viable mining properties. These blocks total 2,261 acres and contain a total of 33.7 million tons of recoverable coal reserves, including about 19 million tons of underground reserves. These unfavorable tracts represent only 1.8 percent of the leased reserves in Colorado. The tracts include several small tracts that had been mined in the past and that were rated as unfavorable because the coal quality, reserves base and geologic conditions were not competitive with other available sources. Table 3-7 summarizes the task force's evaluations.

Task Force Classification of Development Prospects of Colorado Lease Blocks

The Colorado Task Force was asked to evaluate the prospects for development for each lease block. Participants were asked to determine whether each lease block was likely to be producing by 1986 or by 1991. In reaching their conclusions, the Task Force used the following assumptions about development:

1. Additional federal or nonfederal reserves not held by the current lessee are not considered as part of the lease block.

2. The mine would be developed in compliance with all applicable state and federal environmental laws.

3. The production level would satisfy diligence requirements (2 1/2% per year of recoverable reserves in the LMU) or the tract would qualify for an extension of the 1986 diligence date under current guidelines (see discussion in Chapter 2).

4. The production from the mine would be competitive under the market scenario adopted by the task force described in Chapter 2. This

TABLE 3-7: SUMMARY OF TASK FORCE EVALUATIONS - UNDEVELOPED LEASE BLOCKS IN COLORADO

	Number of Blocks	Number of Leases	Acres	Recoverable Reserves (millions of tons)
Totals:	44	68	77,237	1,471
Property Characteristics				
Favorable Mine Properties	31	55	74,976	1,437
Unfavorable Mine Properties	13	13	2,261	33.7
1986 Development Prospects				
Favorable	5	7	9,141	220
Uncertain	5	11	23,132	208
Unfavorable	34	50	44,964	1,044
1991 Development Prospects				
Favorable	10	25	37,692	503
Uncertain	18	22	24,554	837
Unfavorable	16	21	14,991	131

market scenario ranges from a low level established by the CERI market study prepared for the task force to a high level established by the August 1980 DOE production goals.

5. Mine development would proceed as part of the normal and orderly course of business operations.

In reaching their conclusions on the prospects for developing the lease block by 1986 or 1991, the Task Force was encouraged to consider other factors such as the availability of adequate transportation and mining infrastructure, existence of a definite market for the production, environmental conditions—such as impacts on water resources, air quality, recreation, wildlife and wilderness values, and difficult reclamation conditions and impacts on neighboring communities.

The outlook for development by 1986 of existing leases without active mine plans was found to be generally unfavorable. The Task Force identified 5 blocks (7 leases) that were favorable prospects for development by 1986. Five mine blocks (11 leases) were rated as uncertain prospects for 1986. The remaining 34 blocks (50 leases) were rated as unfavorable. The task force classification of the development potential of existing leases in 1986 is consistent with the market scenario that Colorado coal production is not expected to expand significantly over existing and planned operations. For 1991, the task force ratings were more optimistic: the task force classified 10 lease blocks (25 leases) as favorable; 18 blocks (22 leases) as uncertain and 16 blocks (21 leases) as unfavorable.

Blocks that Were Rated as Favorable for Development by 1986

The task force rated five blocks as favorable prospects for development

by 1986. These blocks include seven leases with over 9,140 acres and contain an estimated 220 million tons of recoverable reserves. These favorable blocks represent 7.2 percent of the Colorado's coal lease acreage and 10 percent of the state's recoverable lease reserves.

Four of the favorable blocks are covered by mining plans filed with the OSM Region V in Denver:

#21 - Anchor Coal Leasing, Windjammer Mine;

#22 - Arco, Mt. Gunnison No. 1;

#35 - Belden Enterprises (Grand Mesa Coal Company), Red Canyon Mine;

#37 - Weaver Ohio Creek Mine.

The first two are new large mines. The last two are small mines that are being reopened and expanded.

The other favorable lease block, #6 held by the Peabody Coal Company, will be mined to provide coal to a nearby power plant under a dedication agreement. This tract would maintain production by Peabody operations in this area and would increase the total amount of coal produced in the state.

Blocks that Were Rated as Uncertain in 1986

The task force rated five lease blocks as uncertain prospects for development in 1986. These blocks include 11 leases covering over 23,000 acres and more than 200 million tons of recoverable reserves. These blocks include four blocks with mine plans on file with the Office of Surface Mining:

Four blocks have mine plans on file with the Office of Surface Mining:

#17 and #18 Western Fuels Association - Deserado Project;

#29 Snowmass Coal Company (Anschutz Coal Co.) - Snowmass Mine, Thompson Creek;

#34 Sheridan Enterprises - Loma Complex - McLane Canyon and Munger Canyon Mines.

The Western Fuels and Sheridan Enterprises projects are slated to supply powerplants not yet under construction. Western Fuels/Deserado project will supply the proposed Moon Lake Electric Company power plant in Utah and some coal reportedly will be shipped to meet other contracts until the plant is fully operational. The EIS for the Moon Lake Project is in preparation. Sheridan Enterprises, a subsidiary of Occidental Petroleum, recently announced a contract with the Colorado Ute Power Company to supply the proposed new power plant to be built near Delta, Colorado.

Production from the Snowmass project, which will utilize an advanced longwall technique, will be shipped from Carbondale to serve steam and metallurgical coal markets and possibly some coal exports to Asian customers.

The remaining uncertain block is a potential small mine that would serve spot market or local needs. The mine was previously an underground operation but would probably now be surface mined. It is located in an active mining area where strip reserves are gradually being mined out, thus making marginal strip reserves more desirable.

The major uncertainty for the three planned mines is the time required

to develop an underground mine--and for the two mines with power plant supply contracts there are additional uncertaintaies involving the construction and opening of new power plants.

All three are major new underground mines requiring construction of transportation, loading, and processing facilities. One mine (#29) will install a new longwall mining system in an area with difficult mining conditions and, consequently, is expected to take a longer than average time to reach full production levels.

Two blocks that did not pass the OTA preliminary screens for large mines were rated as uncertain by the task force. Block #1 was so rated because of its strippable reserves and because it met the requirements for a small mine. Blocks 17 and 18 were rated as favorable, despite failing the quality coal criteria. Although the coal is representative of the Lower White River Coal Field, its heat content (estimated at 9,000 to 11,000 Btu/lb) is less than other federal coal in Northwestern Colorado. In this case, however, the location of the mine outweighed coal quality considerations. The coal will be underground mined, and is expected to be transported to the power plant by a 30 mile long overland conveyor system.

Blocks That Were Rated as Unfavorable Prospects for 1986

The remaining 34 blocks with 50 leases were rated as unfavorable prospects for development by 1986. These leases cover 44,964 acres and an estimated 437 million tons of recoverable surface reserves and roughly 600 million tons of recoverable underground reserves. The lease blocks represent 35 percent of the leased federal coal reserves in Colorado.

Some of the unfavorable blocks that are good, mineable properties are

not expected to be sufficiently advanced in development to have reached the production stage by 1986. Many federal leases will have development activities underway and are expected to seek extensions of the 1986 diligence requirements. Some operators might meet diligence by petitioning to combine their undeveloped leases with their nearby producing leases into a logical mining unit. Others might request extensions on the basis of mine size, a new mining technology, or synthetic fuels development, long term contract commitments or unforeseeable and unavoidable delays beyong the control of the lessee.

The unfavorable prospects for 1986 include 21 of the Task Force's 31 favorable mine properties, including seven blocks that passed the OTA preliminary screens and 14 blocks that did not.

Thirteen unfavorable blocks did not pass the OTA preliminary screens and were also rated as unfavorable development properties by the task force. Their prospects are not expected to change in the near term.

Task Force Assessments of Development Prospects for 1991

The task force then considered which lease blocks might be in production by 1991. Ten of the blocks were rated as favorable, 18 as uncertain, and 16 as unfavorable prospects for production in 1991.

Blocks That Were Rated as Favorable for 1991

The 10 favorable blocks have a total of 25 leases and cover over 37,600 acres. They contain an estimated 7.5 million tons of recoverable surface reserves and over 495 million tons of recoverable underground reserves. The favorable lease blocks include four of the five blocks that were rated as favorable in 1986 (#6, #21, #22, and #35). The fifth block (#37), is a small mine that is expected to be depleted by 1991.

Four blocks that were rated as favorable in 1991 were rated as uncertain prospects in 1936 (#17, #18, #29 and #34). All of these mines are expected to be at or near full-scale operations by 1991. Two of these blocks are new operations for lessees with existing active mines. One would be increased production from a new mine, the other would be a shift in existing production to a new site.

Blocks That Were Rated as Uncertain for 1991

The 18 blocks that were rated as uncertain prospects for production in 1991 include 21 leases with a total of more than 24,500 acres and contain an estimated 837 million tons of recoverable reserves. The task force classified these blocks as uncertain for several different reasons.

Mining of one block (#2) with underground reserves was deemed to be dependent on whether strippable coal deposits on adjacent federal lands were

leased in the upcoming Green River - Hams Fork Lease sale in 1981. The higher costs of mining of the block's underground reserves might then be offset by the larger, more economic stripping operation. If the adjacent tracts are not mined, this block is not considered a likely prospect for 1991.

The uncertain development prospects for three lease blocks (#5, 41, 42) were tied to alternative fuels projects. One lease tract held by W.R. Grace was suggested as a possible source for Grace's proposed synthetic fuels plant. Grace has a joint venture in an area to the south and it is also possible that they would use this tract as an alternative source of coal for more conventional uses when strippable coal reserves in northwestern Colorado are expected to be depleted in the 90's.

Development of two tracts held by Peabody Coal Company in the Denver Basin would require a near site use such as a power plant or other facility. (#41, 42) One possibility being explored is to use the coal for process heat in converting agricultural products to methanol in a biofuels plant, thus using the coal indirectly in producing liquid fuels.

Development of the lease blocks shared by Kemmerer Coal Company and Consolidation Coal Company in the North Park area was determined to be contingent on improvements in the availability of transportation to move the coal to market.(31 A, B, C and D)

Several lease blocks in the Meeker area (in the Danforth Hills Coal Field) held by Consolidation Coal Company (#12,13,14 and 15) and Utah International (16), were rated uncertain because of unresolved issues involving the issuance of associated PRLA's, and surface owner consent issues. One tract

held by Utah International, although reported to have sufficient reserves to sustain an average new mine, would probably only be developed if the lease obtained sufficient additional acreage and reserves to allow operation of a very large surface mine similar to the adjacent Colowyo mine. The proposed mine would be similar to an open pit operation and would strip 400 to 800 feet of overburden.

Large scale operations at these potential large mine sites in and around Meeker were also said to be dependent on the construction of rail lines into the area to handle the coal shipments. In the absence of adequate rail systems, coal is currently hauled by truck on public highways near Craig. Although the surrounding community tolerates this traffic as a temporary condition, truck haulage would rise to nearly unmanageable levels if the new mines went into operation.

Two small mine properties were rated as uncertain, however, the task force expects that the opportunity will exist for small mine production in the area.(#1 and 9) Both lessees had previously submitted proposed mine plans for these tracts. Both mines are expected to operate at more than double OTA's small mine criteria of 50,000 ton/year, and thus would probably require some additional reserves to support long term operations. The task force felt that future depletion of strip reserves would make these tracts more desirable.

One tract (#19) was rated as uncertain because the task force members felt that it was very likely that it would become, either by assignment or operating agreements, part of the operations on the adjacent Deserado Project supplying Moon Lake Electric's planned new generating plant. However, no such agreement has yet been consummated. If the block is not

made part of the Deserado Project, the prospects for independent development were characterized as unfavorable/poor.

Three blocks held by U.S. Steel Corporation in the Somerset area were also rated as uncertain based on the task force expectation that they would be developed as part of a company strategy to expand coal operations to steam coal.(#23,24,25) The coal on these blocks is not of metallurgical quality. These blocks would probably be strip mined and could use U.S. Steel's existing loading and other facilities in Somerset. U.S. Steel currently operates a mine at Somerset that supplies its Geneva, Utah steel plants. U.S. Steel had threatened to shut down this plant, but recently U.S. Steel and EPA announced an agreement on the steps required to bring the plant into compliance with Clean Air regulations. This agreement has apparently prevented a shut-down at the Geneva works and subsequent production cutbacks at U.S. Steel's mining operations in Colorado and Utah.

Blocks that Were Rated as Unfavorable for 1991

The Colorado task force rated 16 lease blocks as unfavorable prospects for development in 1991. These blocks contain a total of 21 leases covering nearly 15,000 acres and encompassing 130 million tons of recoverable reserves, mostly underground. The unfavorable blocks account for 11.8 percent of the total recoverable lease reserves in Colorado.

The 16 lease blocks include 15 blocks (20 leases) that were rated as unfavorable prospects for development in 1986, and one single-lease block that was rated as favorable in 1986. The latter block, part of a small mine which is currently being expanded and reopened, is expected to be depleted by 1990 and thus was rated as unfavorable by the task force.

Twelve of the 16 unfavorable lease blocks were also rated as unfavorable mine properties by the task force. All of the blocks classified as unfavorable for 1991 failed the preliminary screens for new mines. Four of the small blocks met the minimum requirements for new small mines. The task force rated four blocks as favorable mine properties but, because of other considerations, ranked them as unfavorable prospects for development in 1991.

Two blocks in the Tongue Mesa Region held by Kemmerer Coal Company were considered unlikely to be in production in 1991 because of their remoteness, the lack of adequate transportation, and lack of markets. These blocks failed the initial screens because the coal quality was considered less marketable than competing sources in Colorado. (#38 A and B)

One block held by the CF&I Steel Company was rated as unfavorable because the lessee has more attractive non-federal reserves in the area than

this single lease block composed of small, scattered parcels of federal coal. (#40)

Although ten small mine properties were rated as unfavorable in 1991, the task force expressed the opinion that small mines would have some opportunity in the next decade. In general, these properties had lower coal quality than other small tracts, or were remnants of larger, developed tracts held by large operators who would not be interested in developing a small tract without additional reserves; or, were held by individuals who lacked resources or coal mining experience to develop a small mine.

Task Force Estimates of Potential Production from Undeveloped Federal Leases

During the Colorado Task Force Meeting, OTA asked the task force participants to estimate the production potential for the lease blocks that were rated as having favorable or uncertain prospects for development. In reaching their estimates, members drew upon their knowledge of lease blocks and of expected small mining and market conditions. Task force estimates of the potential production from each block are shown in Table 3-8

The Task Force estimated that the favorable lease blocks could produce 0.76 to 1.81 million tons in 1986. That amount represents full production for two small mines and start-up production levels for three other mines. The one uncertain lease block could add about 50,000 tons of production in 1986.

This 1986 production represents 0.21 to 1.26 million tons of new production, and 0.6 million tons that is expected to replace existing production from a currently operating mine anticipated to be depleted by

TABLE 3-8
TASK FORCE ESTIMATES OF 1985 AND 1990 PRODUCTION FROM LEASE BLOCKS

Block Number	Lessee	# of Leases	1985 Production	Task Force Rating '86	1990 Production	Task For Rating '
1	AMCA Coal Leasing	1	0	?	0.05	?
2	Franklin Real Estate	1	0	-	0	?
3	Fern James Est.	1	0	-	0	-
4	Prosper Lombardi	1	0	-	0	-
5	W. R. Grace Co.	1	0	-	1-2.0	?
6	Peabody Coal Co.	1	0.6	+	0.6	+
7	Peabody Coal Co.	1	0	-	0	-
8	Peabody Coal Co.	1	0	-	1.0	+
9	Ruby Construction Co.	1	0	-	0	?
10	Sheridan Enterprises	1	0	-	0	-
11	Utah International	1	0	-	0	-
12	Consolidation Coal Co.	2	0	-	1.0	?
13	Consolidation Coal Co.	1	0	-	0	?
14	Consolidation Coal Co.	1	0	-	0	?
15	Consolidation Coal Co.	2	0	-	0	?
16	Utah International	1	0	-	0-1.5	?
17	Western Fuels Assoc.	1	0.05	?	1.3	+
18	Western Fuels Assoc.	1		?		+
19	Riebold & Chapman	1	0	-	0	?
20	Gulf Oil Co.	1	0	-	0	-
21	Arco	3	0-1.0	+	2.8	+
22	Anchor Coal Co.	1	0.1-0.15	+	1.0-1.5	+
23	United States Steel	1	0	-	0.5	?
24	United States Steel	1	0	-	0	?
25	United States Steel	1	0	-	0	?
26	Thompson Creek Coal Co.	1	0	-	0	-
27	Garland Coal Co.	1		Relinquishing Lease		
28	United States Steel	8	0	-	0.5-1.0	+
29	Snowmass Coal Co.	2	0	?	1.0	+
30	AMCA Coal Leasing	1	0	-	0	-
31	Kemmerer Coal Co.	1	0	-	0-0.5	?
32	Wyoming Fuels	1	0	-	0	-
33	Welch & Higgins	1	0	-	0	-
34	Sheridan Enterprises	6	0	?	3.0	+
35	Belden Enterprises	1	0.05	+	0.05	+
36	Utah International	1	0	-	0	-
37	Harry & Opal Weaver	1	0.01	+	0	-
38	Kemmerer Coal Co.	7	0	-	0	-
39	Martinez	1	0	-	0	-
40	CF&I Steel Co.	1	0	-	0	-
41	Peabody Coal Co.	3	0	-	0.5	?
42	Peabody Coal Co.	1	0	-	0	?
			0.81-0.86		14.3-18.3	

1990.

For 1991, the production levels are much higher due to the expectation that new large mines will go into operation. The favorable lease blocks could produce 11.25 to 12.25 million tons of new production.

About 1.1 to 1.6 million tons of 1991 output will replace production at existing operating mines; thus, there could be a net increase in production of 12 to 17 million tons from favorable lease blocks. The uncertain lease blocks could provide an additional 3.05 to 6.05 million tons of coal output if all were to go into production at, or higher than, the expected start-up levels.

Assuming that the production in the state remains at or near currently expected levels, production for developed federal coal leases could total 14.3 to 18.3 million tons of federal coal production annually by 1991.

OTA Review of Task Force Evaluations

After the Task Force, OTA reviewed the task force evaluations of property characteristics and prospects for development. The review was undertaken to meet OTA's responsibility for independent assessments and to conform the Colorado classifications to those used in other task forces. Based on this review, OTA adopted the Task Force classifications of lease development potential with three exceptions. These exceptions were made so that this classification would be comparable to other task forces:

Block No. 2 Franklin Real Estate changed from uncertain to unfavorable. The surrounding new lease tract, the Williams Fork Mountains, was dropped from 1981 new lease sales, thus making

development of the tract under the specified conditions too speculative to be called uncertain. The task force had classified the tract as uncertain for 1991 only if the surrounding area were leased.

Block No. 19 Chapman & Riebold changed from uncertain to unfavorable. OTA does not assume that the necessary transfers in ownership will in fact take place. By itself, under the current lessees, the task force concurred that independent development is unlikely. No assignment of the lease to Western Fuels was recorded with the BLM as of July 1980.

Block No. 37 The Weaver small mine is being expanded and reopened. The block was rated as favorable in 1986 and unfavorable in 1991 because it would be mined out and the availability of additional reserves is questionable. Although the production in 1991 could well be zero, OTA rates this block as favorable for 1991 because it is a developed property.

Based on OTA's review of Task Force evaluations and lease blocks, we have reached our own evaluation of Colorado lease blocks shown in Table 3-8. These final classifications show 11 lease blocks (26 leases) with favorable development potential. Seventeen blocks (22 leases) were rated as unfavorable, and 16 blocks (20 leases) were rated as uncertain.

The 11 favorable blocks cover over 37,770 acres, and 37 million tons of surface recoverable reserves and 466 million tons of underground recoverable reserves. These favorable properties contain almost 23 percent of total recoverable federal leased reserves in the state. According to Task Force estimates, these leases could produce up to 231 million tons in 1986 and 12.25 million tons in 1991.

TABLE 3-9: SUMMARY OF OTA'S FINAL EVALUATION OF UNDEVELOPED LEASE BLOCKS IN COLORADO

	Number of Blocks	Number of Leases	Acres	Recoverable Reserves (million tons)
Totals	44	68	77,237	1,471
Development Potential				
Favorable Development Potential	11	26	37,772	503
Uncertain Development Potential	16	20	22,244	816
Unfavorable Development Potential	17	22	17,221	151

Sixteen of the 44 lease blocks were rated as having uncertain development potential. The major uncertainties are: the availability of new markets, transportation improvements, additional federal leasing, and synfuels development in Colorado. It is possible that all of these tracts could go into production. If so, all would be major new large mines operated by active coal mining companies. All except for Consolidation Coal Company and Kemmerer Coal Company are currently mining in Colorado; and all are reported to be engaged in mine plan preparation activities such as exploration drilling and collection of environmental baseline data. These uncertain lease blocks account for 55.3 percent of the undeveloped lease reserves in Colorado. The blocks cover 411.72 million tons of recoverable surface reserves, and 404.75 million tons of recoverable underground reserves.

Three blocks are associated with alternative fuels projects. One project uses coal indirectly as process heat in converting agricultural products to alcohol fuels (#41 and 42); the other would convert coal to methanol.(#5)

If, in fact, the lessees are moving towards developing all of these uncertain properties, they reflect a trend in western coal industry. Developers are opening new large mines without definite contracts or markets. Some mines are reportedly being put into production in response to the diligence requirements, but most new mine projects seem to be part of a pattern of generally increased and optimistic coal industry activities in the West.

The remaining 17 lease blocks with 22 leases were given an unfavorable final evaluation by OTA. The post-task force review did not uncover any circumstances or changes that might alter these classifications. Also, two

blocks which had been rated as uncertain by the task force were added to this category by OTA. Although OTA agrees with the task force reasoning on both, an unfavorable rating was more appropriate for each so that the task force ratings would be comparable between states.

The unfavorable lease blocks have a total of 22 leases--roughly one sixth of the leases in Colorado. They cover about 17,220 acres and contain a total of 151 million tons of recoverable reserves. These leases represent 5.2 percent of the recoverable reserves of all federal leases in Colorado.

How the Lease Evaluations Will Be Used - Plans for Further Analysis

The information and analyses assembled in the preparation of this report will be used by OTA and its contractors in completing the tasks requested by the Congress--analyzing all mining activities on federal land, determining the development potential of existing leases, estimating federal revenues from rentals and royalties, and examining the feasibility of certain deep mining technologies. The task force draft report and the lease evaluations made by OTA and the task force are a partial contribution to the assessment of existing federal leases. Additional analyses of the technical and economic factors that will influence the development of currently inactive leases are underway. OTA contractors are reviewing all mine plans submitted for federal leases. OTA will continue to consult with federal lessees about their current plans for development and any difficulties the lessees have encountered. OTA has divided the Colorado lease blocks into three groups according to their development prospects, the level of follow-up analysis planned to complete OTA's mandated tasks, and the relative importance of the blocks to the state's coal development future.

Group A. Favorable or Uncertain Lease Blocks with Mine Plans

These leases with mining plans on file with OSM have already been reviewed by OTA's technical contractors. The information obtained from the task force will be used to supplement the mine plan review in determining the development potential of the block, and in estimating future production streams and federal lease revenues. Nine lease blocks are in this category (#9, 17, 18, 21, 22 29, 34, 35, 37).

Group B. Favorable or Uncertain Lease Blocks without Mine Plans

These leases will also be reviewed by OTA's technical contractors. Because no mine plan is on file, the contractor will rely on information obtained from open file sources and the task force in evaluating the potential of the tract and in estimating revenues and coal production. This Group contains 18 lease blocks (1, 5, 6, 8, 12, 13, 14, 15, 16, 23, 24, 25, 28, 31 A&B, 31C, 31D, 41 and 42).

Group C. Unfavorable Lease Blocks

Those blocks that were rated as unfavorable by the task force and by OTA are not expected to go into production over the next decade. In reviewing the leases, no compelling circumstances were identified that might alter the unfavorable classif ations. No additional analyses of these 17 blocks is planned. (#2,3,4,7,10,11,19,20,26,27,30,32,33,36,38A,38B,39 and 40)

APPENDIX A

TASK FORCE INFORMATION

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Congress of the United States
OFFICE OF TECHNOLOGY ASSESSMENT
WASHINGTON, D.C. 20510

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OTA Fact Sheet

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Revised September 1981

OTA COLORADO TASK FORCE PARTICIPANTS

William Bosworth
Director, Environmental Affairs
Sheridan Enterprises, Inc.
9745 East Hampden Avenue, #350
Denver, Colorado 80231

James Cannon
Inform, Inc.
25 Broad Street
New York, New York 10004

Archie Carver
U.S. Geological Survey
Conservation Division
Building 85, Stop MS 602
Denver, Colorado 80225

C. Wayne Cook
Professor Emeritus
Colorado State University
Department of Range Management
Fort Collins, Colorado 80523

Henry E. Davis
Director of Land and Reserve
Development, Rocky Mountain
Division
Peabody Coal Company
12015 East 46th Street
Denver, Colorado 80239

Doran Gillette
Colorado State Office
Bureau of Land Management
Colorado State Bank Building
1600 Broadway
Denver, Colorado 80202

Scott Grace
U.S. Environmental Protection
Agency
Region VIII
1860 Lincoln Street, 8EA
Denver, Colorado 80295

David Huttenlock
Dames & Moore
1626 Cole Boulevard
Golden, Colorado 80401

Dewitt John
Department of Natural Resources
1313 Sherman Street
Room 718
Denver, Colorado 80203

Dan Kimball
Office of Surface Mining
Region V
Brooks Tower
1020 15th Street
Denver, Colorado 80202

Carla Kish
Western Organization of
Resource Councils
419 Stapleton Building
Billings, Montana 59101

Lewis Ladwig
Colorado Geological Survey
Department of Natural Resources
1313 Sherman Street
Room 715
Denver, Colorado 80203

Dan Martin
Bureau of Land Management
Craig District Office
P.O. Box 248
Craig, Colorado 81625

D. Keith Murray
Colorado School of Mines
Research Institute
P.O. Box 112
Golden, Colorado 80401

Martin D. Robbins
Director
Colorado Energy Research Institute
Colorado School of Mines
P.O. Box 112
Golden, Colorado 80401

Chris Seglem
Colorado Westmoreland, Inc.
9034 East Easter Place, Suite 205
Englewood, Colorado 80112

Greg Spanski
U.S. Geological Survey,
Conservation Division
Box 25046
Stop MS 608
Denver Federal Center
Denver, Colorado 80225

Mike Stanwood
Fred C. Hart & Associates
1320 17th Street
Denver, Colorado 80202

Frank Sutherland
U.S. General Accounting Office
Denver Regional Office
2420 W. 26th Avenue
Suite 200-D
Denver, Colorado 80211

Stan Sutton
Colorado School of Mines
Research Institute
P.O. Box 112
Golden, Colorado 80401

Barry Tidwell
U.S. General Accounting Office
Denver Regional Office
2420 W. 26th Avenue
Suite 200-D
Denver, Colorado 80211

Robert Turner
National Audubon Society
Box 3557
Boulder, Colorado 80307

Larry Welborn
Dames & Moore
1626 Cole Boulevard
Golden, Colorado 80401

Martin E. Zeller
Tosco Foundation
1877 Broadway, Suite 505
Boulder, Colorado 80302

OTA STAFF

Audrey Buyrn
Office of Technology Assessment
Materials Program
United States Congress
Washington, D.C. 20510

Karen Larsen
Office of Technology Assessment
Materials Program
United States Congress
Washington, D.C. 20510

Michael McGrath
Office of Technology Assessment
Materials Program
United States Congress
Washington, D.C. 20510

PERSONS INTERVIEWED BY OTA CONTRACTORS
ON ISSUES AFFECTING COLORADO COAL DEVELOPMENT

Mr. Adrian Neisius
Director
BLM District Office
Kremmling, Colorado 80459

Mr. Larry Benna
BLM District Office
Craig, Colorado 81625

Mr. Marvin Pearson
Director
BLM District Office
Craig, Colorado 81625

Mr. Dave Walter
Assistant Director
BLM District Office
Craig. Colorado 81625

Mr. Russ Sorenson
Moffat County Planner
Craig, Colorado 81625

Mr. Jerry Bentrott
Assistant City Administrator
Craig, Colorado 81625

Mr. John Mann
Assistant Director
BLM Area Office
Meeker, Colorado 81641

Mr. John Neys
U.S. Forest Service
District Office
Glenwood Springs, Colorado 81601

Mr. Dave Jones
Director
BLM District Office
Grand Junction, Colorado 81501

Mr. Ted Ford
Mesa County Administrator
Grand Junction, Colorado 81501

Mr. Jim Farley
Mesa County Assessor
Grand Junction, Colorado 81501

Mr. Rob Herrick
U.S. Forest Service District Office
Delta, Colorado 81416

Mr. George Gault
Delta County Planner
Delta, Colorado 81416

Mr. Mark Welsh
Director
Western Slope Energy Resource Council
Hotchkiss, Colorado 81419

Mr. Al Ravenoff
BLM District Office
Montrose, Colorado 81401

Mr. Joe Dearing
Montrose County Planner
Montrose, Colorado 81401

Mr. Mike Serra, President
Energy Area Exchange
Montrose, Colorado 81401

Mr. Curly Baca
Manager, Exploration and Acquisitions
Northern Coal Company
Denver, Colorado 80201

Mr. Terry Thoem
Director Energy and Minerals Division
Environmental Protection Agency
Denver, Colorado 80225

Mr. Jim Bills
Energy and Minerals Division
United Bank
Denver, Colorado 80202

PERSONS INTERVIEWED BY OTA CONTRACTORS

Mr. Charles Margolf
Manager, Coal Operations
W. R. Grace Company
3333 Quebec Street
Denver, Colorado 80207

Mr. Gregory Hoyl
Vice President - Western Division
A. T. Massey Coal Company
1536 Cole Boulevard
Golden, Colorado 80401

Mr. Fred Scherer
Vice President of Coal Operations
ARCO
555 17th Street
Denver, Colorado 80202

Mr. Roger Underwood
Geologist
BLM
Canon City, Colorado 81212

APPENDIX B

MINE DEVELOPMENT PROFILES

AND

PRODUCTION PROJECTIONS

Summary of Conventional Coal Mine Development Models
Colorado

STATE COAL REGION (COAL FIELD)	Heating Value (Btu/lb)	Sulfur (%)	Ash (%)	Coal Thickness (ft.)	Minimum[1] Leasehold Required (acres)	Minimum Recoverable Reserves (tons x 10^6)	Mine Life (yr.)	Design[1] Capacity (tons x 10^6/yr)	Mining Technology[2]	Likely Markets[3]
COLORADO										
Denver Region (Laramie fm.)	6,200-10,800	0.2-1.1	4-20	3-20	75-500	2	20-30	1.2 (U)	S:Conv. U:Shaft	S-EG (Local, Municipal), Conversion?
(Denver fm.)	3,600-6,800	0.2-0.6	10-45	10-55	75-500	2	20-30	1.2 (U)	S:Conv. U:Shaft	S-EG (Local, Municipal), Conversion?
Green River Region										
(Mesaverde fm.)	9,800-12,600	0.3-1.8	3-20	3-20	1,300 (S) 600 (U)	20 (S) 6 (U)	20-30	1-3 (S) 0.3-2 (U)	S:Conv. U:Drift or Slope	S-EG (Colorado, Midwest)
(Lance fm.)	9,600-9,700	0.5-0.7	4-7	7-10	1,300 (S) 600 (U)	20 (S) 6 (U)	20-30	1-3 (S) 0.3-2 (U)	S:Conv. U:Drift or Slope	S-EG (Colorado, Midwest)
(Ft. Union fm.)	8,300-8,700	0.2-0.4	4-8	7-40	1,300 (S) 600 (U)	20 (S) 6 (U)	20-30	1-3 (S) 0.3-2 (U)	S:Conv. U:Drift or Slope	S-EG (Colorado, Midwest)
(Wasatch fm.)	--	--	--	2-20	1,300 (S) 600 (U)	20 (S) 6 (U)	20-30	1-3 (S) 0.3-2 (U)	S:Conv. U:Drift or Slope	S-EG (Colorado, Midwest)
North Park Region (Coalmont fm.)	6,500-11,300	0.2-1.0	2-19	35-60	50	4	Several	0.2-2.0	S:Conv.	S-EG (Colorado, Midwest)
Raton Mesa Region (Raton fm.)	10,200-13,900	0.4-1.1	5-16	7-10	1,100	10	20-30	0.5-0.9	S:Conv. U:Conv. or LW	M (Local, Eastern U.S.), S-EG?
(Vermejo fm.)	11,000-13,500	0.5-1.3	7-22	7-10	1,100	10	20-30	0.5-0.9	S:Conv. U:Conv. or LW	M (Local, Eastern U.S.), S-EG?
San Juan (Fruitland fm.)	9,400-12,100	0.5-0.9	7-27	1-40	20-2,200	1-20	20-30	0.1-1.0	S:Conv. U:Conv.	S-EG, M (Local)
River Region (Menefee fm.)	10,800-14,700	0.6-1.3	3-17	1-40	20-2,200	1-20	20-30	0.1-1.0	S:Conv. U:Conv.	S-EG, M (Local)
(Dakota fm.)	10,100-13,480	0.5-1.1	6-19	1-40	20-2,200	1-20	20-30	0.1-1.0	S:Conv. U:Conv.	S-EG, M (Local)
Uinta Region (Book Cliffs Field)	9,800-13,600	0.4-1.7	5-23	6-9	300	8-9	15-30+	0.4-3 (S) 0.2-2 (U)	S:Conv. U:Conv. or LW	S-EG (West, Midwest, South U.S.) M (Western U.S., Asia)
(Carbondale Field)	12,500-15,200	0.3-1.5	3-10	1-10	300	8-9	15-30+	0.4-3 (S) 0.2-2 (U)	S:Conv. U:Conv. or LW	S-EG (West, Midwest, South U.S.) M (Western U.S., Asia)
(Crested Butte Field)	13,400-14,200	0.4-1.9	5-9	2-10	300	8-9	15-30+	0.4-3 (S) 0.2-2 (U)	S:Conv. U:Conv. or LW	S-EG (West, Midwest, South U.S.) M (Western U.S., Asia)
(Danforth Hills Field)	10,100-12,000	0.3-1.4	2-19	7-40+	300	8-9	15-30+	0.4-3 (S) 0.2-2 (U)	S:Conv. U:Conv. or LW	S-EG (West, Midwest, South U.S.) M (Western U.S., Asia)
(Grandhogback Field)	12,100-12,600	0.6-0.7	6-10	3-18+	300	8-9	15-30+	0.4-3 (S) 0.2-2 (U)	S:Conv. U:Conv. or LW	S-EG (West, Midwest, South U.S.) M (Western U.S., Asia)
(Grand Mesa Field)	8,300-13,500	0.3-2.1	2-18	4-14	300	8-9	15-30+	0.4-3 (S) 0.2-2 (U)	S:Conv. U:Conv. or LW	S-EG (West, Midwest, South U.S.) M (Western U.S., Asia)
(Lower White River Field)	10,800-11,200	0.4-0.5	4-9	8-12+	300	8-9	15-30+	0.4-3 (S) 0.2-2 (U)	S:Conv. U:Conv. or LW	S-EG (West, Midwest, South U.S.) M (Western U.S., Asia)
(Somerset Field)	10,000-13,500	0.5-0.8	3-11	7-30	300	8-9	15-30+	0.4-3 (S) 0.2-2 (U)	S:Conv. U:Conv. or LW	S-EG (West, Midwest, South U.S.) M (Western U.S., Asia)

[1]S=Surface; U=Underground, [2]Conv.=Conventional; LW=Longwall,
[3]S-EG=Steam Electric Generation; M=Metallurgical

Source: Colorado School of Mines Research Institute, Criteria for Determining Viable Mining Properties on Existing Federal Coal Leases in the Western United States, 1980.

INITIAL SCREENING PROCESS FOR UNDEVELOPED FEDERAL COAL LEASES: COLORADO

- Criteria that are independent of coal region and mine profile

CRITERIA	RATIONALE	REFERENCES	INFORMATION SOURCES
1. All leases in the tract are held by the same owner.	Coal operators form mining units out of more than one lease - leases held by the same owner in the same area are presumed to have been acquired for purposes of development. Regulations require that all leases in a logical mining unit (LMU) be under the effective control of a single operator.	DOI Coal Leasing Regulations 43 CFR 3400.0-5(cc) 43 CFR 3475.5	Lease lists with ownership and location obtained from State BLM Offices and DOI coal lease data systems (ACLDS).
2. The lease tract forms a compact and contiguous unit.	Mining units must be sufficiently compact and contiguous to allow for economy of operation and orderly sequence of mining. Regulations require that all leases in an LMU be contiguous - i.e. having at least one point in common.	DOI Coal Leasing Regulations 43 CFR 3400.0-5(cc) 43 CFR 3400.0-5(k)	Official public land records - coal plat maps from State BLM office and coal lease maps at various scales from USGS and BLM.

Criteria that vary with region and mine types (3 cases):

CASE 1 - large surface mine producing steam coal

1-3 The lease tract has sufficent recoverable reserves to support a new surface mine: at least 500,000 tons/year with 30 year life (15 million tons, total recoverable reserves).	Review of planned new mines indicate trend towards surface mines of at least 500,000 tons/year; projected mine life of 30 years required to recover costs.	CSMRI mine survey and profile of anticipated mine requirements; consultations with USGS, BLM District Offices and State Geological Survey.	Recoverable and in-place coal reserve estimates from ACLDS (DOI-BLM) system and from independent sources such as EIS's. OTA staff/consultant calculations of resources.
1-4 Coal reserves meet minimum coal quality standards for expected end use (steam coal) • at least 10,000 BTU/lb (at least 9,000 BTU/lb. for North Park Field). • sulfur content of 0.7% or less • ash content of 12% or less	Coal quality characteristics reflect lower limits of BTU/lb, % sulfur, and % ash to meet expected demand for Colorado coal over next decade. (North Park Field coals are marketable with slightly lower BTU/lb because they compete with Wyoming coal.)	CSMRI profiles of typical new mine requirements; consultations with USGS and coal industry executives; Chase Manhattan Bank Outlook for Metallurgical Coal in Domestic Markets; U.S. Bureau of Mines studies of met coal reserves.	Coal quality information from DOI coal lease data system plus supplementary information from EIS's and F.E.R.C. report summaries published in Coal Outlook.

CRITERIA	RATIONALE	REFERENCES	INFORMATION SOURCES
1-5 Geologic characteristics of the coal reserves and topographic conditions impose no restrictions on mine design or coal recovery. i.e., single/multiple seams of bituminous or subbituminous coal at least 72" thick and coal beds with low dips; surface reserves are under 250 feet of overburden or less.	Engineering requirements for mine design and equipment make mining under certain conditions difficult and costly and limit recoverability. Rips over 15° are difficult to mine; however, seams with dips up to 60° are being mined in Colorado.	CSMRI mine survey; USGS publications; consultations with USGS and industry sources. Conditions in Colorado, equipment requirements and current mining practices were reviewed with USGS and BLM, and State Geological Survey concerning the Denver Basin.	Geologic information from DOI automated coal data system; USGS reports.
1-6 Lessee has financial capability and/or mining experience to develop the tract. i.e., mining expertise or financial resources to support initial capital costs of $5-10 million.	Initial capital costs to open a new surface mine are estimated to be $5-10 million. Lessee must be able to obtain financing for mine development - costs exclude lease acquisition.	Presidents Commission on Coal Data Book. A. Cornett, Colorado Mining Assoc. 1976 Mining Yearbook; DOE Energy Information Admin., Economic Analysis of Coal Mining Costs for Underground and Strip Operations.	OTA study of federal leaseholders including information on individual and corporate lessees, current and past mining experience, and assets based on lessee disclosure statements in lease records, state corporation commissions, industry directories, direct interviews with lessees and coal industry sources, and investment sources. Review of state agencies' public records. Ownership information on file with BLM summarized by OTA contractor and supplemented by independent research in financial services.

CRITERIA	RATIONALE	REFERENCES	INFORMATION SOURCES
CASE 2 - large underground mining operations for steam coal, metallurgical, or industrial markets			
2-3 The lease tract has sufficient recoverable reserves to support an average new deep mine, at least 500,000 tons/year with a life of 30 years. (Recoverable reserves of 15 million tons.)	Existing deep mines in Colorado produce from 100,000 t 800,000 tons. Some coal industry executives believe that new mines less than 1 MTY will not be developed in the 1980's.		
2-4 Coal reserves meet minimum coal quality standards for expected end use (steam or met coal) • at least 12,000 BTU/lb • sulfur content of 0.7% or less (sulfur content of 1.0% or less for Coal Basin Field) • ash content of 10% or less	Coal quality characteristics reflect lower limits of BTU/lb, % sulfur, and % ash to meet expected demand for Colorado coal over next decade. Colorado has a large amount of "premium" grade metallurgical coal which is 1% S or less and 8% ash or less; "marginal" grade met coal has up to 1.8% S, and up to 12% ash. (Coal Basin coals with high BTU values are marketable with up to 1.0% sulfur)		
2-5 Geologic characteristics of the coal reserves and topographic conditions do not impose restrictions on mine design or coal recovery. i.e., underground seams are at least 72" thick and coal beds have mineable dips; underground reserves are under 250 feet or more of overburden.	Geo-engineering requirements for mine design and equipment make mining in some regions of Colorado difficult and costly and limit recoverability. Dips of more than 8° are difficult, however seams dipping up to 30° are being mined underground in Colorado.	SEE INFORMATION UNDER CASE 1, ABOVE	
2-6 Lessee has financial capability and/or mining experience to develop the tract. i.e., mining expertise and financial resources to support initial capital costs of $25-35 million.	Minimum capital costs to open a new 500,000 ton/year deep mine are estimated by a coal industry executive at $25 million (1980 dollars) for a "poor boy" operation. ($50 per annual ton) Published sources estimate, for 20 year mine life, $65 per annual ton. Recent Chase Manhattan report on met coal put costs of a 1 MTY deep met coal mine at $65 million.		

CRITERIA	RATIONALE	REFERENCES	INFORMATION SOURCES
CASE 3 - small surface or underground mine producing coal for utility, industrial, or spot markets and local use			
3-3 The lease tract has sufficient recoverable reserves to support an average new mine of 50,000 tons/year production with a mine life of 20 years (recoverable reserves of 1.0 million tons)	District BLM representatives were interviewed; some identified a need for small mine production to serve local needs: 50,000 tons/year (and possibly less) produced by an individual or small company. Past local mining operations ranged from 4000 tons/year with hand sorting (Ohio Creek #2) to 11,000 tons/year. (Apex and King Coal) Trend is to reduction in number, and increase in production from small mines. Minimum mine life of 20 years required to cover costs for the small operator.		
3-4 Coal reserves meet minimum coal quality standards for expected end use (lump coal) • at least 10,000 BTU/lb • sulfur content of 1.0% or less • ash content of 10% or less	Coal quality characteristics reflect lower limits of BTU/lb, % sulfur, and % ash to meet local demands over next decade. Low moisture content and low ash are important properties for coal competing for local markets.		
3-5 Geological characteristics of the coal reserves and topographic conditions do not impose restrictions on mine design or coal recovery. e.g., single or multiple seams at least 36" thick and coal beds; minable dips; reserves are under shallow overburden.	Geo-engineering uncertainties (geological conditions in most areas of Colorado are complex) for mine design and equipment make mining difficult and costly and may limit recoverability. Seam dips not a limiting factor for small mines. Existing mines are operating in seams up to 60°.		
3-6 Lessee has financial capability and/or mining experience to develop the tract. e.g., mining expertise and financial resources to support initial capital costs of $1-2 million	Initial capital costs to open a "poor boy" 500,000 ton/year mine for the most skilled, innovative small operator are estimated at $1-2 million (1980 dollars). Baseline drilling and environmental studies for surface mining operations could cost $500,000, plus equipment for truck and shovel operation. Deep mining (e.g.) ventilation and safety requirements plus equipment (for example, a continuous miner at $500,000) could easily exceed $1,000,000).		

Table 5. Coal Production Goals for 1985, 1990 and 1995 by Western States (million short tons)[a]

State	1985			1990			1995		
	Low	Medium	High	Low	Medium	High	Low	Medium	High
E. No. Great Plains									
North Dakota	29.0	29.0	29.0	34.3	50.8	59.7	53.6	85.6	103.7
South Dakota	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.9	1.9
Eastern Montana	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Total	29.3	29.3	29.3	34.6	51.1	60.0	53.9	87.8	105.9
Powder River Basin									
Montana	53.9	56.6	79.3	57.2	109.4	176.4	98.4	211.3	385.0
Wyoming	133.5	136.6	142.3	148.6	185.1	235.8	161.0	279.5	388.8
Total	187.4	193.2	221.6	205.8	294.5	412.2	259.4	490.8	773.8
Rest of Wyoming	55.3	57.8	66.7	59.5	71.4	81.6	74.1	104.4	130.1
Colorado	33.8	33.9	38.2	28.3	35.1	43.3	35.0	49.3	59.9
Utah	25.1	30.2	35.1	35.9	48.8	63.0	49.2	74.2	82.6
New Mexico	33.3	37.7	44.2	55.9	64.1	67.4	61.0	71.8	77.4
Central West	15.0	15.2	16.7	14.8	21.5	26.9	18.3	32.7	44.7
Gulf	69.7	69.7	70.1	121.9	151.6	209.7	161.7	213.5	213.5
Arizona	12.1	12.1	12.1	11.2	11.6	11.6	11.2	11.5	11.8
Northwest	3.4	4.2	3.7	4.7	5.3	6.2	5.4	6.7	7.2
Alaska	b	b	b	b	b	1.9	b	3.8	5.
TOTAL	464.4	483.3	537.7	572.6	755.0	983.8	729.2	1146.5	1512.6

[a]Some totals differ slightly from corresponding totals in Table 4 due to rounding.
[b]Negligible

Source: U.S. Department of Energy, The 1980 Biennial Update of National and Regional Coal Production Goals for 1985, 1990, and 1995, March 1981.

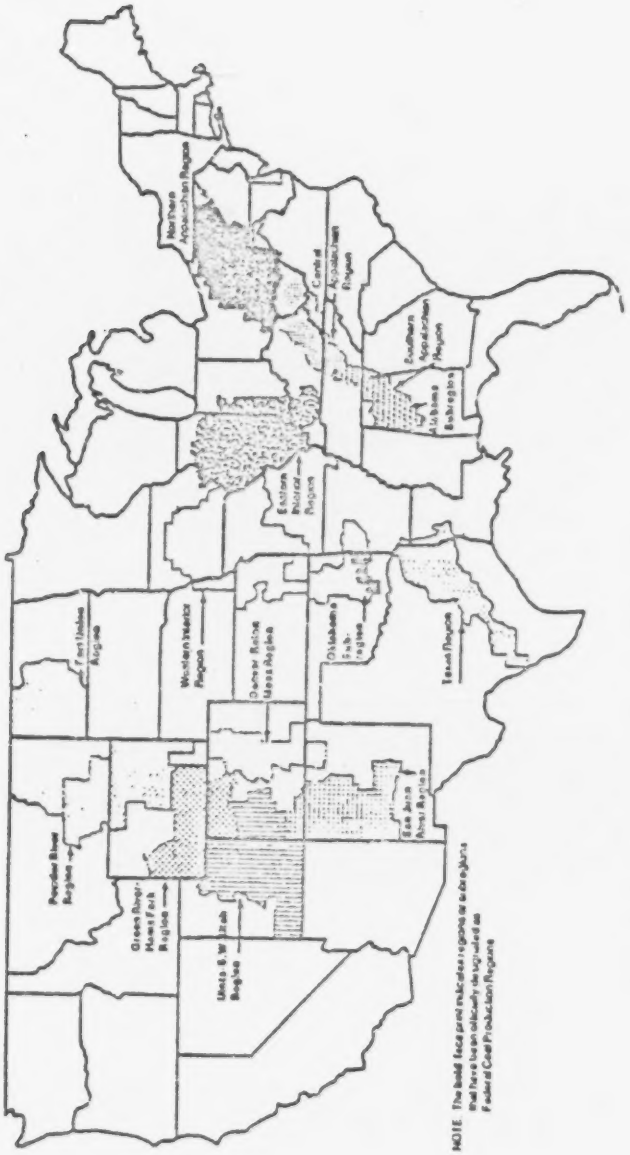
Northern Appalachian Region
Central Appalachian Region
Southern Appalachian Region
Alabama Subregion
Eastern Interior Region
Western Interior Region
Oklahoma Sub-Region
Texas Region
Fort Union Region
Denver Basin Uinta Region
San Juan River Region
Powder River Region
Green River-Hams Fork Region
Uinta S.W. Utah Region
NOTE: The bold face print indicates regions which have been historically designated as Federal Coal Production Regions

Figure 2. DOI Coal Production Regions

Table 6. Coal Production Goals for 1985, 1990, and 1995 by DOI Coal Production Regions (million short tons)

Region	1985			1990			1995		
	Low	Medium	High	Low	Medium	High	Low	Medium	High
No. Appalachia	179.8	194.5	215.9	222.7	291.0	341.5	270.0	372.3	494.7
Cen. Appalachia	198.2	208.7	224.6	214.7	230.2	257.6	202.5	229.5	255.2
So. Appalachia	18.5	19.5	20.6	16.0	17.0	18.4	13.6	15.9	19.5
Eastern Interior	179.7	211.8	246.0	243.7	327.0	384.6	303.7	450.0	484.3
Western Interior	15.0	15.2	16.7	14.8	21.5	26.9	18.3	32.7	44.7
Fort Union	29.3	29.3	29.3	34.6	51.1	60.0	53.9	85.9	105.9
Powder River	187.1	193.2	221.6	205.8	294.3	412.2	259.1	490.9	773.8
Green River - Hans Pork	73.9	76.5	88.6	75.1	90.8	105.3	93.4	130.9	160.9
Uinta-S.W. Utah	36.4	41.4	47.1	45.8	60.5	76.7	60.8	89.2	101.2
Denver-Raton Mesa	5.3	6.3	7.8	4.2	10.5	14.3	7.4	18.4	24.2
San Juan River	31.9	35.4	40.7	54.5	57.6	58.9	57.6	61.2	63.7
Texas[a]	69.7	69.7	70.1	121.9	151.6	209.7	161.7	213.5	213.5
Total[b]	1024.8	1101.5	1229.0	1253.8	1603.1	1966.1	1502.0	2190.4	2710.6

[a]Includes Louisiana.
[b]Not equal to totals in Tables 4 and 5 because DOI regions do not cover all coal producing areas.

Source: U.S. Department of Energy, The 1980 Biennial Update of National and Regional Coal Production Goals for 1985, 1990, and 1995, March 1981.

U.S. DEPARTMENT OF ENERGY, The 1980 Biennial Update of National and Regional Coal Production Goals for 1985, 1990, and 1995, March 1981

Table 10. Comparison of Coal Production Goals to Selected State Production Forecasts for 1985 and 1990 (million short tons)[a]

State	Actual 1979	1985				1990			
		State Forecast	Goals			State Forecast	Goals		
			Low	Medium	High		Low	Medium	High
North Dakota	15.0	38.7	29.0	29.0	29.0	71.1	34.3	50.8	59.7
Montana	32.5	81.2	54.2	56.9	79.6	130.2	57.5	109.7	176.7
Wyoming	71.8	146.5	188.8	194.4	209.0	167.5	208.1	256.5	317.4
Colorado	18.1	23.9	33.8	33.9	38.2	n.a.	28.3	35.1	43.3
New Mexico	15.1	47.0	33.3	37.7	44.2	57.5	55.9	64.1	67.4
Utah	11.8	18.0	25.1	30.2	35.1	28-44	35.9	48.8	63.0

[a]State forecasts are not available for 1995.

Table A-2. 1990 Coal Production Goals for Western DOI Planning Regions by Coal Type and Mining Method
(10^6 tons)

REGION/BASIN	Low		Medium		High	
	Surface	Deep	Surface	Deep	Surface	Deep
Western Interior						
Metallurgical	0.0	0.33	0.0	0.33	0.0	0.39
Bituminous	5.31	12.66	6.76	25.66	7.62	36.66
Fort Union						
North Dakota Lignite	53.57	0.0	83.57	0.0	103.72	0.0
Eastern Montana Lignite	0.31	0.0	0.31	0.0	0.31	0.0
Powder River						
Western Montana						
Bituminous	0.0	11.20	0.0	26.04	0.0	32.40
Subbituminous	86.96	0.0	185.89	0.0	332.62	0.0
Northeastern Wyoming						
Subbituminous	161.02	0.0	279.39	0.0	388.01	0.0
Green River-Hams Fork						
Southwestern Wyoming						
Bituminous	58.76	12.69	63.86	17.89	65.56	61.89
Subbituminous	2.65	0.0	2.65	0.0	2.65	0.0
Northwestern Colorado						
Bituminous	16.72	4.64	16.72	11.76	15.57	15.16
Subbituminous	0.0	0.0	0.0	0.0	0.0	0.0
Uinta-Southwestern Utah						
West Central Colorado						
Metallurgical	0.0	3.16	0.0	3.16	0.0	3.16
Bituminous	0.10	8.41	0.10	11.76	0.44	15.10
Southwestern Utah*						
Bituminous	1.72	47.47	1.72	73.10	2.23	88.33
Denver-Raton Mesa						
Eastern Colorado						
Bituminous	0.0	3.24	0.0	6.34	0.0	7.94
Subbituminous	0.11	0.43	0.11	0.37	0.11	1.31
Northeastern New Mexico						
Bituminous	0.0	3.83	0.0	11.68	0.0	14.80
San Juan River						
Southwestern Colorado						
Bituminous	0.0	0.28	0.0	1.02	0.0	1.31
Northwestern New Mexico						
Bituminous	54.31	2.97	59.59	6.57	59.59	6.97
Texas						
Texas & Louisiana						
Lignite	161.71	0.0	213.47	0.0	213.47	0.0
TOTAL	681.15	111.06	918.14	212.56	1,206.76	377.20

*Includes all Utah production.

Source: U.S. Department of Energy, The 1980 Biennial Update of National and Regional Coal Production Goals for 1985, 1990 and 1995, March 1981.

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Table 19. Regional Demands for Coal by Synthetic Fuel Plants (quads)

Coal Type and Demand Region	Low			Medium and High		
	1985	1990	1995	1985	1990	1995
Bituminous[a]						
Colorado (CO)					.192	.577
Eastern Kentucky (EK)		.096	.192		.192	.577
Illinois (IL)	.096	.192	.192	.096	.289	.385
Southern Ohio (OS)					.192	.385
Texas (TX)		.096	.096		.192	.192
Utah (UT)					.192	.577
Western Kentucky (WK)					.192	.577
Western Pennsylvania (WP)			.192		.385	.385
West Virginia (WV)	.096	.192	.192	.096	.385	.577
Alabama (AL)		.096	.192		.096	.192
Sub-bituminous[b]						
Montana (MT)		.192	.192		.385	.770
New Mexico (NM)		.096	.192		.192	.577
Wyoming (WY)	.096	.385	.385	.096	.385	.770
Lignite[c]						
North Dakota (DK)	.096	.192	.385	.096	.385	.770
Texas (TX)			.096		.192	.385
Total[d]	.385	1.540	2.309	.385	3.849	7.698

[a] 11,000 Btu/lb or 22 million Btu/st
[b] 9,000 Btu/lb or 18 million Btu/st
[c] 7,000 Btu/lb or 14 million Btu/st
[d] Total demand may differ slightly from sum of state demands due to rounding.

Source: U.S. Department of Energy, The 1980 Biennial Update of National and Regional Coal Production Goals for 1985,1990 and 1995, March 1981.

Table 20. Distribution of Synfuel Plants by NCM Demand Regions[a]

Year	NCM Aggregate Demand Region	Synfuel Plant Sites[b]	Synfuel Demand Level Low	Medium and High
1985[c]				
	E. No. Central	IL	1	1
	Total East		1	1
	W. No. Central	DM	1	1
	Mountain	WY	1	1
	Total West		2	2
	Grand Total		3	3
1990				
	Middle Atlantic	WP	1	2
	South Atlantic	WV		2
	E. No. Central	IL,OS	1	3
	E. So. Central	EK,WK	1	2
	Total East		3	9
	W. No. Central	DM	1	2
	W. So. Central	TX	1[d]	2
	Mountain	MT,CO,WY,UT,NM	4[d]	7
	Total West		6	11
	Grand Total		9	20
1995				
	Middle Atlantic	WP	1	2
	South Atlantic	WV	1	3
	E. No. Central	IL,OS	2	5
	E. So. Central	EK,WK	1	6
	Total East		5	16
	W. No. Central	DM	2	4
	W. So. Central	TX	2[d]	3
	Mountain	MT,CO,WY,UT,NM	4	17
	Total West		8	24
	Grand Total		13	40

[a]Plants have a capacity of 50,000 barrels per day, unless otherwise indicated.
[b]See Table 12 for explanation of region codes.
[c]Includes only plants of 25,000 barrels per day.
[d]Includes one plant of 25,000 barrels per day.

Source: U.S. Department of Energy, The 1980 Biennial Update of National and Regional Coal Production Goals for 1985, 1990 and 1995, March 1981.

SOURCE: U.S. Department of Energy, Western Coal Survey, 1981

Table 19
WESTERN COAL SURVEY

PERIODIC SUMMARY

STATE OF COLORADO

	OPERATION	ACTUAL PRODUCTION	PRODUCTIVE CAPACITY: MILLION TONS PER/YEAR											
		78	80	81	82	83	84	85	86	87	88	89	90	
	Archeleta County													
	PERMA Chimney Rock	*	*	0.2	0.2	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
	Delta County													
	PITTSBURG & MIDWAY Farmers		-	-	-	-	-	-	-	1.0	1.5	2.0	2.0	U
	QUINN DEVELOPMENT CO Tomahawk		0.1	0.2	0.2	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	U&S
F	WESTERN ASSOC. Red Canyon		0.1	0.2	0.4	0.7	1.0	1.0	1.0	1.0	1.0	1.0	1.0	U
F	WESTMORELAND Orchard Valley		0.8	1.0	1.2	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	U
	County Total	0.5	1.0	1.4	1.8	2.6	2.9	2.9	2.9	3.9	4.4	4.9	4.9	
	El Paso County (BOM 16)													
	A.T. MASSEY Bacon		0.2	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
	Freemont County													
PRLA	DORCHESTER COLOMINE Dorchester #1		0.2	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	U
	County Total	0.1												
	Garfield County													
F	SHERIDAN ENT. Loma 1&2		*	*	0.1	0.2	0.3	0.6	1.0	1.3	1.7	2.0	2.4	U
	County Total	0.1												
	Gunnison County													
F	ARCO Mt. Gunnison		-	-	0.2	0.5	1.0	1.4	2.0	2.8	2.8	2.8	2.8	U
F	BEAR COAL Bear		0.2	0.2	0.2	0.2	0.2	-	-	-	-	-	-	U
F	U.S. STEEL Somerset 3/		1.0	1.0	1.0	1.0	1.0	1.0	0.8	0.8	0.8	0.8	0.8	U M
F	WESTERN SLOPE CARBON Hawk's Nest		1.0	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	U M
	County Total	1.2	2.2	2.7	2.9	3.2	3.7	3.9	4.3	5.1	5.1	5.1	5.1	
	Huerfano County													
	PERMA Colorado Coal Mine #1		-	0.2	0.5	0.8	1.0	1.5	1.5	1.5	1.5	1.5	1.5	
	County Total	*												
	Jackson County													
F?	AMCA 1/ Unnamed		-	-	-	-	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
F	KERR Marr		0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	
F	WYOMING FUEL 2/ Sigma		0.1	0.2	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	
	County Total	0.7	0.8	0.9	1.0	1.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	

1/ Property bought from Getty Oil.
2/ 50% owned by Iowa Public Service.
3/ Also in Delta County - All production reported in Gunnison.
* Less than 50,000 tons.

F = Federal; PRLA = Preference Right Lease

Table 19 - continued
DOE WESTERN COAL SURVEY 1981

PERIODIC SUMMARY

STATE OF COLORADO

	OPERATION	ACTUAL PRODUCTION	PRODUCTIVE CAPACITY: MILLION TONS PER/YEAR											
		78	80	81	82	83	84	85	86	87	88	89	90	
	La Plata County													
	C&F Hay Gulch		-	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	
	PERMA Colorado Pacific Energy		-	-	-	-	-	-	-	-	0.5	0.8	1.2	U
	County Total	0.8	-	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.9	1.2	1.6	
	Las Animas County													
	CF&I STEEL Allen		0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	U M
	CF&I STEEL Maxwell		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	U M
	FREEPORT Lorencito		-	-	-	-	0.2	0.6	0.6	0.6	0.6	0.6	0.6	U&S M
	County Total	0.6	1.2	1.2	1.2	1.2	1.4	1.8	1.8	1.8	1.8	1.8	1.8	
	Mesa County													
F	COAL FUELS Anchor **		*	1.0	1.0	2.0	2.0	2.0	2.0	2.0	3.0	3.0	4.0	U
	DORCHESTER COLOMINE Fruita		0.2	0.3	0.4	0.6	0.8	1.0	1.0	1.0	1.0	1.0	1.0	U
F	GEX-COLORADO INC. Cameo		0.6	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	U
F	GEX-COLORADO INC. Roadside		0.6	0.8	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	U
	County Total	0.4	1.4	3.1	3.5	4.7	4.9	5.1	5.1	5.1	6.1	6.1	7.1	
	Moffat County													
F	EMPIRE ENERGY Eagle #5		0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	U
	EMPIRE ENERGY Eagle #6&7		-	-	-	0.2	0.6	0.6	1.0	1.0	1.0	1.0	1.0	U
F	EMPIRE ENERGY Eagle #9		0.2	0.2	0.6	0.6	0.6	0.6	1.0	1.0	1.0	1.0	1.0	U
	ENERGY FUELS Sugarloaf		-	-	-	-	1.0	2.0	2.5	2.5	2.5	2.5	2.5	
F	HANNA MINING Colowyo		2.5	3.0	3.0	3.5	4.3	4.3	4.3	4.3	4.3	4.3	4.3	
PRLA, F	UTAH INTERNATIONAL Danforth Hills		-	-	-	-	1.5	1.5	1.5	1.5	1.5	1.5	1.5	
F	UTAH INTERNATIONAL Trapper		2.3	2.3	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.9	
	County Total	2.8	5.6	6.1	7.0	7.7	11.4	12.4	13.7	13.7	13.7	13.7	13.8	
	Montezuma County													
	PERMA Colorado Pacific Aztec Gasification		-	-	-	-	-	-	-	-	2.5	4.0	5.0	
	Montrose County													
F	KEMMERER Tongue Mesa ***		-	-	-	-	-	-	0.5	1.0	1.5	1.5	1.5	U
	County Total	0.1												

* Less than 50,000 tons.
**Also in Garfield County.

***Also in Ouray & Gunnison County.

Table 19 - continued

DOE WESTERN COAL SURVEY 1981

PERIODIC SUMMARY

STATE OF COLORADO

	OPERATION	ACTUAL PRODUCTION 78	PRODUCTIVE CAPACITY: MILLION TONS PER/YEAR 80	81	82	83	84	85	86	87	88	89	90	
	Pitkin County													
F	MID-CONTINENT Dutch Creek #1		0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	U M
F	MID-CONTINENT Dutch Creek #2		0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	U M
F	MID-CONTINENT Coal Basin		0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	U M
F	MID-CONTINENT L.S. Wood		0.3	0.3	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	U M
F	WESTERN ASSOC. COAL-NICOR 3/ Thompson (Snowmass. Creek 1&3		0.1	0.3	0.4	0.5	0.6	0.8	0.9	0.9	0.9	0.9	0.9	U M
	County Total	0.9	1.1	1.3	1.8	1.9	2.0	2.2	2.3	2.3	2.3	2.3	2.3	
	Rio Blanco County													
F	NORTHERN #1		0.1	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	U
F	NORTHERN #2		-	-	*	0.2	0.6	1.0	1.0	1.0	1.0	1.0	1.0	U
F	NORTHERN #3		-	-	*	0.3	0.8	1.5	1.5	1.5	1.5	1.5	1.5	U
F	NORTHERN Reinau #2		0.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	U
F	WESTERN FUELS Deserado		-	-	-	0.1	0.5	0.9	1.5	2.2	2.4	2.8	2.8	U
	County Total	*	0.2	0.9	0.9	1.5	2.8	4.3	4.9	5.6	5.8	6.2	6.2	
	Routt County													
	COAL FUELS Dawson		*	0.5	1.0	1.0	1.0	1.6	1.0	2.0	2.0	2.0	2.0	U
F	ENERGY FUELS Energy No. 2		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
F	PEABODY Seneca		1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	U&S
F	PITTSBURG & MIDWAY Edna Strip		1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	U&S
F	PITTSBURG & MIDWAY Fish Creek		-	-	-	-	0.1	0.3	0.3	0.6	0.6	1.0	1.3	U
F	PITTSBURG & MIDWAY Trout Creek		-	-	-	0.1	0.3	0.4	0.4	0.4	0.4	0.4	0.4	U
	SUN COAL Meadow #1		*	0.3	0.3	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	
	S COAL Trout Creek #2		-	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	U
F	WR GRACE-HANNA MINING Hayden Gulch		0.6	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	-	
	County Total	6.0	7.2	8.3	9.0	9.1	9.5	9.9	10.0	11.4	11.5	12.0	11.6	
	Weld County (BOM 16)													
	COORS Kingsberg		-	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	
	RME Erie		-	-	-	0.2	0.4	0.5	0.5	0.5	0.5	0.5	0.5	
	County Total	0.1	-	0.6	0.6	0.8	1.0	1.1	1.1	1.1	1.1	1.1	1.1	
	State Total	13.8	21.1	28.1	31.3	36.7	45.9	50.7	54.1	58.8	. 5	58.0	70 5	
	Small mines	1.4												
	Large mines	12.4												

3/ Previously referred to as Anshutz-West Assoc. Coal

* Less than 50,000 tons.

Table 20

DOE WESTERN COAL SURVEY 1981

PERIODIC SUMMARY

STATE OF COLORADO

	OPERATION	COAL UNDER CONTRACT: MILLION TONS PER/YEAR										
		80	81	82	83	84	85	86	87	88	89	90
	Delta County											
F	WESTMORELAND Orchard Valley	0.8	1.0	1.2	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
	Gunnison County											
F	U.S. STEEL Somerset	1.0	1.0	1.0	1.0	1.0	1.0	0.8	0.8	0.8	0.8	0.8
	Others	0.8	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
	County Total	1.8	2.1	2.1	2.1	2.1	2.1	1.9	1.9	1.9	1.9	1.9
	Las Animas County											
	CF&I STEEL Allen	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
	CF&I STEEL Maxwell	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	County Total	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
	Mesa County											
F	GEX-COLORADO INC. Cameo	0.6	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
F	GEX-COLORADO INC. Roadside	0.6	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
	County Total	1.2	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
	Moffat County											
F	EMPIRE ENERGY Eagle #5	0.6	0.6	0.6	0.6	0.6	0.6	-	-	-	-	-
F	HANNA MINING Colowyo *	2.0	2.0	2.0	2.0	4.3	4.0	4.0	4.0	4.0	4.0	4.0
F	UTAH INTERNATIONAL Trapper	2.3	2.3	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.9
	County Total	4.9	4.9	5.4	5.4	7.7	7.4	6.8	6.8	6.8	6.8	6.9
	Pitkin County Total	1.0	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	Rio Blanco County											
F	WESTERN FUELS Deserado**	-	-	-	0.1	0.5	0.9	1.5	2.2	2.4	2.8	2.8

* Underground mine feasibility study underway.
** Formerly Moon Lake Electric.

Table 20 - continued

DOE WESTERN COAL SURVEY 1981

PERIODIC SUMMARY

STATE OF COLORADO

	OPERATION	COAL UNDER CONTRACT: MILLION TONS PER/YEAR										
		80	81	82	83	84	85	86	87	88	89	90
	Routt County											
F	ENERGY FUELS Energy No. 2	4.0	4.0	4.0	4.0	1.0	1.0	1.0	-	-	-	-
F	PEABODY Seneca	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
F	PITTSBURG & MIDWAY Edna Strip	1.0	1.0	1.0	1.0	1.0	1.0	0.5	0.5	0.5	0.5	0.5
F	WR GRACE-HANNA MINING Hayden Gulch	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	-
	County Total	7.1	7.1	7.1	7.1	4.1	4.1	3.6	2.6	2.6	2.6	2.0
	Weld County											
	COORS Kingsberg	-	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	State Total	18.0	19.0	19.8	20.1	19.8	19.9	19.2	18.9	19.1	19.5	19.0

APPENDIX C

BACKGROUND INFORMATION ON

UNDEVELOPED LEASES

FEDERAL COAL LEASES IN COLORADO

DEVELOPMENT STATUS - SEPTEMBER 30, 1980

COLORADO - Green River Region

LESSEE: PARENT/SUBSIDIARY	LEASE BLOCK OR MINE NAME	MINE PLAN STATUS	NUMBER OF LEASES	SERIAL NUMBER	DATE	ACRES	COUNTY
Consolidated Gas & Oil Corp./ Sunland Mining Corp.	Apex No. 2	Approved	2	C0127592	10/1/66	80	Routt
				D046544	12/3/37	160	
						240	
General Dynamics Corp./Material Service Corp. --Peabody Holding Co./Peabody Coal Co.	Seneca 2W	Approved	3	C081251	5/1/65	2519	Routt
				C081258	5/1/65	2323	
				C19885	7/1/63	125	
						4967	
General Electric Co./Utah International, Inc.	Trapper	Approved	4	C25948	12/1/66	85	Moffat
				C07518	6/1/58	2566	
				C07519	6/1/58	1372	
				C079641	10/1/62	1352	
						5375	
Getty Oil Co./Energy Fuels Co.	Energy Fuels No. 1 & 2	Approved	7	C0128433	6/1/75	475	Routt
				C081330	11/1/63	2215	
				C16284	7/1/78	263	
				C20900	11/1/78	420	
				C22644	7/1/79	1790	
				C22676	9/1/79	402	
				D052547	3/1/45	1145	
						6710	
Getty Oil Co./Kerr Coal Co.	Marr	Approved	1	C22777	7/1/80	770	Jackson
Gulf Oil Corp./--	Edna Strip	Approved	4	C021601*	6/1/62	827	Routt
				D033327	4/23/25	280	
				D041478	5/6/30	80	
				D053710	6/10/47	89	
						1276	
Hanna Mining Corp. and W.R. Grace & Co./Colowyo Coal Co.	Colowyo Strip	Approved	1	D034365	10/25/24	2545	Moffat
Internorth Corp./Northern Minerals Co.	Meeker Area	Approved	5	C1545	9/1/67	896	Rio Blanco
				C28358	6/1/67	886	
				C28359	6/1/67	1000	
				C076713	2/1/66	320	
				D044240	1/12/33	160	
						3262	

*Lease #C021601 is also in Gulf Oil Corp.'s pending Trout Creek underground mine plan.

COLORADO - Green River Region (continued)

LESSEE: PARENT/SUBSIDIARY	LEASE BLOCK OR MINE NAME	MINE PLAN STATUS	NUMBER OF LEASES	SERIAL NUMBER	DATE	ACRES	COUNTY
Kansas Nebraska Natural Gas Co./ Wyoming Fuels Co.	Canadian Strip	Approved	1	C27931	3/1/80	90	Jackson
Standard Oil of Indiana Co./Empire Energy Corp.	Eagle No. 5 & 9	Approved	3	C0126480 C012?865 D056298	1/1/66 1/1/66 12/1/49	367 43 41 451	Moffat
Gulf Oil Corp./--	Trout Creek	Pending	1	C021601*	6/1/62	827	Routt
Lombardi, Prosper/--	Johnnie's	Pending	1	C23396	1/1/79	80	Routt
Western Fuels Associates/--	Desperado	Pending	2	D047201 C023703	7/25/36 3/1/63	513 2557 3070	Rio Blanco
AMCA Resources/AMCA Coal Leasing, Inc.	--	Undeveloped	1	C030472	7/1/60	120	Jackson
AMCA Resources/AMCA Coal Leasing, Inc.	--	Undeveloped	1	D051376	10/8/40	250	Routt
American Electric Power Co./Franklin Real Estate Co.	Cardinal	Undeveloped	1	C012894	12/1/56	634	Routt
Chapman, Russell W. and Kieboid, Paul	--	Undeveloped	1	C028875	11/1/31	1675	Rio Blanco
Conoco, Inc./Consolidation Coal Co.	--	Undeveloped	2	C093714 C093715	6/1/67 6/1/67	571 760 1331	Rio Blanco
Conoco, Inc./Consolidation Coal Co.	--	Undeveloped	1	C1546	9/1/67	1097	Rio Blanco
Conoco, Inc./Consolidation Coal Co.	--	Undeveloped	1	C245	1/1/56	226	Rio Blanco
Conoco, Inc./Consolidation Coal Co.	--	Undeveloped	2	C093713 C093716	6/1/67 6/1/67	2518 2061 4579	Rio Blanco

*Lease No. C021601 is also in Gulf Oil Corp.'s approved Edna Strip Mine.

COLORADO - Green River Region (continued)

LESSEE: PARENT/SUBSIDIARY	LEASE BLOCK OR MINE NAME	MINE PLAN STATUS	NUMBER OF LEASES	SERIAL NUMBER	DATE	ACRES	COUNTY
Conoco Inc./Consolidation Coal Co. and Gulf Oil Corp./Kemmerer Coal Co.	--	Undeveloped	1	C0105299	6/1/68	560	Jackson
Conoco Inc./Consolidation Coal Co. and Gulf Oil Corp./Kemmerer Coal Co.	--	Undeveloped	1	C0105300	6/1/68	1680	Jackson
Conoco Inc./Consolidation Coal Co. and Gulf Oil Corp./Kemmerer Coal Co.	--	Undeveloped	1	C0123177	8/1/66	1707	Jackson
General Electric Co./Utah International, Inc.	--	Undeveloped	1	C0123476	12/1/66	2252	Moffat
General Electric Co./Utah International, Inc.	--	Undeveloped	1	C813	4/1/70	160	Moffat
James, Ferne H. (estate)/--	--	Undeveloped	1	C064416	1/1/66	40	Moffat
Kansas Nebraska Natural Gas Co./ Wyoming Fuels Co.	--	Undeveloped	1	D057166	6/21/51	173	Jackson
Occidental Petroleum Corp./Sheridan Enterprises, Inc.	Joe's	Undeveloped	1	D052546	9/27/48	160	Routt
Peabody Holding Co./Peabody Coal Co.	Seneca	Undeveloped	1	C0114093	5/1/64	1320	Routt
Peabody Holding Co./Peabody Coal Co.	--	Undeveloped	1	C086654	7/1/63	160	Routt
Peabody Holding Co./Peabody Coal Co.	Seneca II	Undeveloped	1	C08819	7/1/63	2280	Routt
Ruby Construction Co./--	Sun	Undeveloped	1	D051698	9/11/41	146	Routt
W.R. Grace & Co./--	--	Undeveloped	1	C0125957	10/1/65	3863	Moffat

COLORADO - Uinta Region

LESSEE: PARENT/SUBSIDIARY	LEASE BLOCK OR MINE NAME	MINE PLAN STATUS	NUMBER OF LEASES	SERIAL NUMBER	DATE	ACRES	COUNTY
Atlantic-Richfield Co./--	Bear	Approved	1	D044569*	8/30/34	1340 (1000 adj.)	Gunnison
General Exploration, Inc./Cambridge Coal Co.	Roadside	Approved	1	C078049	8/1/66	810	Mesa
General Exploration, Inc./GEX Colorado	Cameo	Approved	1	C01538	6/1/51	2560	Mesa
Northwest Energy Corp./Western Slope Carbon, Inc.	Hawksnest East	Approved	4	C17130	12/1/73	241	Gunnison
				C27103	10/1/79	290	
				D042921	2/25/31	819	
				D056724	12/1/50	189	
						1539	
Mid Continent Resources, Inc./--	Coal Basin	Approved	9	C12640	5/1/66	1520	Gunnison
				C0115606	1/1/65	80	
				C011646	10/1/58	957	
				C0125456	4/1/61	80	
				C030345	4/1/61	117	
				C074632	12/1/66	680	
				C0125457	10/1/58	1142	Pitkin
				C09004	5/1/61	1529	
				C09005	11/1/58	1365	
						7479	
U.S. Steel Corp./--	Somerset	Approved	3	C033301**	1/7/60	625	Delta
				C033302	1/7/64	1548	
				D052504	8/19/44	3470	
						5643	
Weaver, Henry L. and Opal/--	Ohio Creek No. 2	Approved	1	C069942	4/1/62	80	Gunnison
Westmoreland Coal Co./Colorado Westmoreland Inc.	Orchard Valley	Approved	2	C25079	3/1/78	310	Delta
				C27432	9/1/79	854	
						1164	

*Lease No. D044569 is being mined by Tony Bear Coal Co. under sublease from Atlantic Richfield Co. It is also in Atlantic-Richfield Co.'s Mt. Gunnison pending mine plan.

**Lease C033301 is also part of the proposed Blue Ribbon Mine which is under sublease to Sunflower Energy as operator for U.S. Steel Corp.

COLORADO - Uinta Region (continued)

LESSEE: PARENT/SUBSIDIARY	LEASE BLOCK OR MINE NAME	MINE PLAN STATUS	NUMBER OF LEASES	SERIAL NUMBER	DATE	ACRES	COUNTY
Anschutz Corp./--	Sunniss	Pending	2	C08172	6/1/58	2413	Pitkin
				C08171	6/1/58	2469	
						4882	
Atlantic-Richfield Co./--	Mt. Gunnison No. 1	Pending	3	C011792	6/1/65	1243	Gunnison
				C01362	9/1/67	4836	
				D044569*	12/27/77	1340	
						7420	
Eastern Gas & Fuel Associates and NICOR, Inc./Belden Enterprises	Colby Red Canyon	Pending	1	D036906	4/1/24	41	Delta
Mid Continent Resources, Inc./ Mid Continent Limestone Co.	Coal Canyon	Pending	3	C037277	10/1/62	1471	Mesa
				C059420	10/1/65	308	
				D040389	5/21/32	241	
						2021	
Occidental Petroleum Corp./ Sheridan Enterprises, Inc.	Loma Complex	Pending	6	C0125436	5/1/68	2446	Garfield
				C0125437	5/1/68	2357	
				C0125438	5/1/68	2560	
				C0125439	5/1/68	2483	
				C0125515	5/1/68	2560	
				C0125516	5/1/68	2523	
						14929	
Pitkin Iron Corp./-- --James Brothers Coal Co./-- --James, Richard, Jr., James, Kermit L., and Pitkin Iron Corp.	Cottonwood Creek	Pending	3	C020740	10/1/58	40	Mesa
				C029889	11/1/64	2522	
				C024998	10/1/63	2551	
						5113	
St. Joe Minerals Corp./Anchor Coal Co.	Windjammer	Pending	1	D052501	8/20/45	280	Gunnison
U.S. Steel Corp./--	Blue Ribbon	Pending	1	C033301**	1/7/60	625	Gunnison
Garland Coal & Mining Co./--	Thompson Creek	Undeveloped	1	C012765	6/1/60	498	Pitkin
General Electric Co./Utah International, Inc.	Green Valley	Undeveloped	1	D055156	10/18/48	174	Delta

*Lease No. D044569 is being mined by Tony Bear Coal Co. under sublease from Atlantic-Richfield Co. It is also in Atlantic-Richfield Co.'s Mt. Gunnison pending mine plan.

**Lease C033301 is also part of United States Steel Corp. s approved Somerset Mine.

COLORADO - Uinta Region (continued)

LESSEE: PARENT/SUBSIDIARY	LEASE BLOCK OR MINE NAME	MINE PLAN STATUS	NUMBER OF LEASES	SERIAL NUMBER	DATE	ACRES	COUNTY
Gulf Oil Corp./--	Peonia Farmer's	Undeveloped	1	D036955	12/28/23	280	Delta
Gulf Oil Corp./Kemmerer Coal Co.	Tongue Mesa	Undeveloped	6	C0120078	1/11/68	2001	Montrose
				C0120079	1/11/68	2560	
				C0120080	1/11/68	1600	
				D038385	3/1/29	360	
				C0120073	1/11/68	2240	
				C0120077	1/11/68	1242	Ouray
						10002	
Gulf Oil Corp./Kemmerer Coal Co.	Tongue Mesa	Undeveloped	1	C0120076	1/12/68	2320	Ouray
Thompson Creek Coal & Coke Co./--	--	Undeveloped	1	D037766	11/5/27	120	Gunnison
U.S. Steel Corp./--	Coal Basin	Undeveloped	8	C0125485	1/1/65	200	Gunnison
				C030344	5/1/60	517	
				C12638	1/1/65	715	
				C12639	12/1/66	800	
				C1894	12/1/66	120	
				C7852	12/1/66	160	
				C030346	5/1/60	640	
				C7853	1/1/65	717	
						3469	
U.S. Steel Corp./--	--	Undeveloped	1	C068389	9/1/61	560	Gunnison
U.S. Steel Corp./--	--	Undeveloped	1	C051669	9/1/61	1092	Gunnison
U.S. Steel Corp./--	--	Undeveloped	1	D052558	8/19/44	214	Gunnison
Welch, Evelyn and Wiggins, Shirley/--	Harvey Gap	Undeveloped	1	D043937	4/5/32	120	Garfield

COLORADO

Denver-Raton Mesa and San Juan Region

LESSEE: PARENT/SUBSIDIARY	LEASE BLOCK OR MINE NAME	MINE PLAN STATUS	NUMBER OF LEASES	SERIAL NUMBER	DATE	ACRES	COUNTY
Denver-Raton Mesa							
Crane Co./CF&I Steel Co.	--	Undeveloped	1	C067	7/1/52	962	Los Animas
Martinez, Albert/--	--	Undeveloped	1	F058043	9/11/41	40	Los Animas
Peabody Holding Co./Peabody Coal Co.	Denver Basin	Undeveloped	3	C0112685 C0112686 C0112687	12/1/67 12/1/67 12/1/67	640 640 644	Elbert
						1924	
Peabody Holding Co./Peabody Coal Co.	Denver Basin	Undeveloped	1	C0126477	12/1/67	760	Elbert
San Juan Region							
National King Coal, Inc./--	King Coal	Approved	1	F058300	9/11/41	160	La Plata

COLORADO LEASE BLOCKS

COAL BASIN/FIELD	BLOCK NO.	LESSEE	LEASE NO.	ACRES	COUNTY	LOCATION	MINE PLAN: OSM **
YAMPA FIELD	1	Amax Coal Leasing	D051376	250.41	Routt	T3N, R86W, s12,13	
	2	Franklin Real Estate (W.R. Grace)	C012894	634.42	Routt	T5N, R89W, s,7,8	
	3	Fern M. James, Est.	C0e4416	40.10	Moffat	T6N, R91W, s10	
	4	Prosper Lombardi	C23396	80.00	Routt	T4N, R86W, s33	✓
	5	~~Peabody Coal Co.~~ (W.R. Grace)	C0125957	3863.00	Moffat	T8N, R89W, s9,10 15,17-22	
	6	Peabody Coal Co.	C0114093	1320.00	Routt	T5N, R87W, s17-20 20-30	?
	7	Peabody Coal Co.	C086654	160.00	Routt	T6N, R87W, s10	
	8	Peabody Coal Co.	C088199	2280.00	Routt	T6N, R87W, s21,22 27,28,32-35	
	9	Ruby Construction Co.	D051698	146.26	Routt	T4N, R89W, s12	
	10	Sheridan Enterprises	D052546	160.0	Routt	T4N, R86W, s22,23	
DANFORTH HILLS	11	Utah International	C813	159.55	Moffat	T6N, R91W, s24	
	12	Consolidation Coal	C093713	2517.98	RioBlanco	T2N, R93W, s1,2,11-14,24	
		Consolidation Coal	C083716	2060.71	RioBlanco	T1N, R93W, s2, T2N R93W,24-24,35,36	
	13	Consolidation Coal	C245	225.86	RioBlanco	T2N, R93W, s5 T3N, R93W, s33	
	14	Consolidation Coal	C1546	1096.73	RioBlanco	T2N, R93W, s9,10 15,16	

** Leases included in mining plans at OSM (✓) Uncertain

COLORADO LEASE BLOCKS

COAL BASIN/FIELD	BLOCK NO.	LESSEE	LEASE NO.	ACRES	COUNTY	LOCATION	MINE PLAN: OSM
DANFORTH HILLS	15	Northern Minerals (from Consol)	C073714	571.5	RioBlanco	T2N, R93W, s23,24	
		Northern Minerals	C093715	760.00	RioBlanco	T1N, R93W, s2 T2N, R93W, s26,35	
	16	Utah International	C0123476	2255.22	Moffat	T3N, R93W, s5,6 T4N, R93W, s29,31,32	
LOWER WHITE RIVER	17	Western Fuels (Moon Lake Elec.)	C023703	2557.22	RioBlanco	R2N, R101W, s1-4 T3N, R93W, s33	✓
	18	Western Fuels (Reliable Coal)	D047201	513.0	RioBlanco	T2N, R101W, s2,3, 10,11	✓
	19	Russell Chapman & Paul Riebold	C028875	1675.22	RioBlanco	T2N, R101W, s10,11 13-15	
SOMERSET FIELD	20	Gulf Oil Co. (Paonia Farmers' Mine)	D036955	380.0	Delta	T13S, R91W, s17,18	
	21	Arco (Mt. Gunnison No. 1)	C0117192	1443.49	Gunnison	T13S, R90W, s17-20	✓
		Arco	C1362	4836.36	Gunnison	T13S, R90W, s27-30 32-34, T14S, R90W, s3,4,9,10	✓
		Arco (Bear Mine-1seam)	D044569	1339.76	Gunnison	T13s, R90W, s9,16,21	✓
	22	Anchor Coal Co. (Windjammer Mine)	D052501	280.00	Gunnison	T13S, R90W, s17	✓
	23	U.S. Steel Corp.	C051669	1092.33	Gunnison	T13S, R90W, s10,30 T13S, R91W, s23,24	
	24	U.S. Steel Corp.	C068389	560.0	Gunnison	T14S, R90W, s16,31	
	25	U.S. Steel Corp.	D052558	213.99	Gunnison	T13S, R90W, s14,15	

COLORADO LEASE BLOCKS

COAL BASIN/FIELD	BLOCK NO.	LESSEE	LEASE NO.	ACRES	COUNTY	LOCATION	MINE PLAN: OSM
COAL BASIN FIELD							
	26	Thompson Creek Coal	D037766	120.0	Gunnison	T11S, R88W, s5,6	
	27 *	Garland Coal & Mining	C012765	497.64	Pitkin	T11S, R88W, s6 T11S, R89W, s1	
	28	U.S. Steel Corp.	C0125485	200.00	Gunnison	T10S, R89W, s28,33 T10S, R90W, s25	
		U.S. Steel Corp.	C030344	516.52	Gunnison	T10S, R89W, s28-30 T10S, R90W, s25	
		U.S. Steel Corp.	C030346	640.0	Gunnison	T10S, R89W, s28,33-35	
		U.S. Steel Corp.	C12638	315.29	Gunnison	T10S, R90W, s25,36	
		U.S. Steel Corp.	C12639	800.0	Gunnison	T10S, R89W, s31-33	
		U.S. Steel Corp.	C1894	120.0	Gunnison	T10S, R89W, s33	
		U.S. Steel Corp.	C7852	160.0	Gunnison	T10S, R89W, s32,33	
		U.S. Steel Corp.	C7853	717.32	Gunnison	T10S, R89W, s28-33	
	29	Anschutz Corp.	C08172	2413.05	Pitkin	T9S, R89W, s22,27-31, 33,34	
		Anschutz Corp.	C08173	2468.90	Pitkin	T8S, R89W, s22,27,34 T9S, R89W, s3,10,14 15,22,23	
NORTH PARK FIELD							
	30	AMCA Coal Leasing	C030472	120.0	Jackson	T7N, R81W, s14	
	31A&B	Kemmerer Coal Co.- 50%; Consolidation Coal Co. 50%	C0105299	560.0	Jackson	T7N, R80W, s38,32,33	
	31C	" "	C0105300	1680.0	Jackson	T7N, R81W, s21,27 28,33,34	

* In process of relinquishing lease.

COLORADO LEASE BLOCKS

COAL BASIN/FIELD	BLOCK NO.	LESSEE	LEASE NO.	ACRES	COUNTY	LOCATION	MINE PLAN: OSM
NORTH PARK FIELD							
	31D	Kennecott Coal Co.- 50%, Consolidation Coal Co. 50%	C0123177	1706.92	Jackson	T7N, R80W, s29-31 T7N, R81W, s23,25,26	
	32	Wyoming Fuels (assigned from Monolith Portland Cement)	D057166	172.75	T9N, R78W, s19		
Grand Hogback	33	Evelyn Welch & Shirley Eiggins	D043937	120.25	Garfield	T5S, R91W, s19 T5S, R92W, s13	
Book Cliffs	34	Sheridan Enterprises	C0125436	2446.19	Garfield	T7S, R102W, s5,10, 18,20	✓
		Sheridan Enterprises	C0125437	2357.46	Garfield	T7S, R102W, s3,4,10 15,22	✓
		Sheridan Enterprises	C0125438	2560.0	Garfield	T7s, R102W, s8,17-20	✓
		Sheridan Enterprises (McClain Canyon)	C0125439	2482.98	Garfield	T7S, R102W, s9,15,16 21,22	✓
		Sheridan Enterprises (Munger Canyon)	C0125515	2559.98	Garfield	T7S, R102W, s27,28 33,34	✓
		Sheridan Enterprises	C0125516	2522 72	Garfield	T8S, R102W, s2-4,10	
GRAND MESA FIELD	35	Belden Enterprises Colby-Red Canyon Inc. Plan	D036906	41.29	Delta	T13S, R95W, s12	✓
	36	Utah International (Green Valley - inactive)	D055156	173.70	Delta	T13S, R94W, s7 T13S, R95W, s12	
	37	Harry L. & Opal Weaver	C069942	80.0	Gunnison	T15S, R86W, s16	

COLORADO LEASE BLOCKS

COAL BASIN/FIELD	BLOCK NO.	LESSEE	LEASE NO.	ACRES	COUNTY	LOCATION	MINE PLAN: OSM
TORREJE MESA FIELD							
	38	Kemmerer Coal Co.	C01200	2240.54	Gunnison	T47N, R7W, s34-36	
		Kemmerer Coal Co.	C0120078	2000.00	Montrose	T47N, R7W, s14-17,21	
		Kemmerer Coal Co.	C0120079	2560.00	Montrose	T47N, R7W, s21-27	
		Kemmerer Coal Co.	C0120080	1600.25	Montrose	T47N, R7W, s2-4,9-11 & 14, T48N, R7W, s34	
		Kemmerer Coal Co.	D038385	360.0	Montrose	T47N, R7W, s25,26	
		Kemmerer Coal Co.	C0120076	2320.0	Ouray	T46N, R7W, s10,11,14 15,16,22,23	
		Kemmerer Coal Co.	C0120077	1241.93	Ouray	T47N, R7W, s28,33,34	
DENVER BASIN	41	Peabody Coal Co.	C0112685	640.0	Elbert	T10S, R58W, s20	
		Peabody Coal Co.	C0112686	640.0	Elbert	T10S, R58W, s28	
		Peabody Coal Co.	C0112687	643.68	Elbert	T10S, R58W, s30	
		Peabody Coal Co.	C0126477	760.0	Elbert	T10S, R58W, s6,8 T10S, R59W, s12	
RATON MESA (Trinidad Field)	39	Albert Martinez	P058043	40.0	LasAnimas	T33S, R65W, s11	
	40	CF&I Steel Co.	C067	961.92	LasAnimas	T33S, R67W, s15,17-19,21,22,27-29	

Summary of Geological Characteristics and

Coal Quality for Undeveloped Leases

BLOCK NO.	LESSEE	LEASE NO.	ACRES	COUNTY	TYPE OF RESERVES	RECOVERABLE RESERVES *	BTU/LB	SULFUR %	ASH %	THICKNESS (Feet) *	OVERBURDEN	DIP (Degrees)
1	Anca Coal Leasing	D051376	250.41	Routt	U&S	>1	12,200	0.60	4.0		?	10-12
2	Franklin Real Estate (W.R. Grace)	C012894	634.42	Routt	U	<15	11,290	0.50	3.5		?	6
3	Fern M. James, Est.	C064426	40.10	Moffat	S	<1	10,620	0.05	5.0		?	?
4	Prosper Lombardi	C23396	80.00	Routt	U	<1	12,340	0.7	4.6		?	2
5	W. R. Grace	C0125957	3863.00	Moffat	U&S	>15	10,000	0.5	7.0		200	?
6	Peabody Coal Co.	C0114093	1320.00	Routt	S	<15	10,285-12,250	4 Seams 0.5-1.7	4 Seams 4.0-9.5		?	12
7	Peabody Coal Co.	C086654	160.00	Routt	U	<15	10,240-12,550	3 Seams 0.5-0.6	3.7-14.7		?	?
8	Peabody Coal Co.	C088199	2280.00	Routt	S	>15	10,240-12,550	0.50	3.7-14.7		?	?
9	Ruby Construction Co.	D051698	146.26	Routt	S	>1	12,000	0.5-0.6	5.0-5.6		?	9
10	Sheridan Enterprises	D052546	160.0	Routt	U	<1	12,150	1.9	6.3		?	?
11	Utah International	C813	159.55	Moffat	U	<15	---	--	?		?	8

* Actual coal reserves and thicknesses are confidential; Estimated reserves shown.

BLOCK NO.	LESSEE	LEASE NO.	ACRES	COUNTY	TYPE OF RESERVES	RECOVERABLE RESERVES *	BTU/LB	SULFUR %	ASH %	THICKNESS (Feet) *	OVERBURDEN	DIP (Degrees)
12	Consolidation Coal	C093713	2517.98	RioBlanco	U&S	>100	12,000	0.8	10.0		--	--
	Consolidation Coal	C083716	2060.71	RioBlanco			12,000	0.8	10.0		---	---
13	Consolidation Coal	C245	225.86	RioBlanco	U	<15	12,000	0.80	10.0		---	---
14	Consolidation Coal	C1546	1096.73	RioBlanco	U	>15	12,000	0.80	10.0		---	---
15		C093714	571.5	RioBlanco	U	>100	12,000	0.80	10.0		---	---
		C093715	760.00	RioBlanco			12,000	0.80	10.0		---	---
16	Utah International	C0123476	2255.22	Moffat	S	>15	10,710	0.50	6.9		---	8
17	Western Fuels (Moon Lake Elec.)	C023703	2557.22	RioBlanco	U	31	11,070	0.40	4.9		---	5
18	Western Fuels (Reliable Coal)	D047201	513.0	RioBlanco	U		11,070	0.40	4.9		---	5-6
19	Russell Chapman & Paul Riebold	C028875	1675.22	RioBlanco	U	>15	7,036	0.40	---		30-60	---

BLOCK NO.	LESSEE	LEASE NO.	ACRES	COUNTY	TYPE OF RESERVES	RECOVERABLE RESERVES *	BTU/LB	SULFUR %	ASH %	THICKNESS (Feet)*	OVERBURDEN	DIP (Degrees)
20	Gulf Oil Co. (Paonia Farmers' Mine)	D036955	380.0	Delta	U	1	12,280	0.50	4.5		---	---
21	Arco (Mt. Gunnison No. 1)	C0117192	1243.49	Gunnison	U	203	12,217-12,870	0.20-0.77	4.2-9.3		---	3
	Arco	C1362	4836.36	Gunnison			"	"	"		"	"
	Arco (Bear Mine-1seam)	D044569	1339.76	Gunnison			"	"	"		"	"
22	Anchor Coal Co. (Windjammer Mine)	D052501	280.00	Gunnison	U	5.4	12,580-12,870	0.50	5.7-7.8		---	---
23	U.S. Steel Corp.	C051669	1092.33	Gunnison	U&S	>15	12,690-12,870	0.50	5.2-8.5		---	---
24	U.S. Steel Corp.	C068389	560.0	Gunnison	U&S	<15	11,400-11,900	0.5-0.6	7.5-14.5		---	---
25	U.S. Steel Corp.	D052558	213.99	Gunnison	U	<15	12,650	0.50	5.6		---	---

BLOCK NO.	LESSEE	LEASE NO.	ACRES	COUNTY	TYPE OF RESERVES	RECOVERABLE RESERVES *	BTU/LB	SULFUR %	ASH %	THICKNESS (Feet) *	OVERBURDEN	DIP (Degrees)
26	Thompson Creek Coal	D037766	120.0	Gunnison	U	> 1	13,750	0.99	8.7		---	25
27 *	Garland Coal & Mining	C012765	497.64	Pitkin	U	—		—	—		—	—
28	U.S. Steel Corp.	C0125485	200.00	Gunnison	U	>15	13,780	0.60	8.0		---	---
	U.S. Steel Corp.	C030344	516.52	Gunnison			12,446	0.48-2.08	6.9-17.7		---	22
	U.S. Steel Corp.	C030346	640.0	Gunnison			---	1.37	10.9		---	22
	U.S. Steel Corp.	C12638	315.29	Gunnison			12,690	0.50	8.5		---	---
	U.S. Steel Corp.	C12639	800.0	Gunnison			12,690	0.50	8.5		---	---
	U.S. Steel Corp.	C1894	120.0	Gunnison			12,690	0.50	8.5		---	---
	U.S. Steel Corp.	C7852	160.0	Gunnison			12,690	0.50	8.5		---	---
	U.S. Steel Corp.	C7853	717.32	Gunnison			12,690	0.50	8.5		---	---
29	Anschutz Corp	C08172	2413.05	Pitkin	U	85	12,640-14,000	0.80-0.90	9.3-16.4		---	---
	Anschutz Corp.	C08173	2468.90	Pitkin			12,640-14,000	0.80-0.90	9.3-16.4		---	---

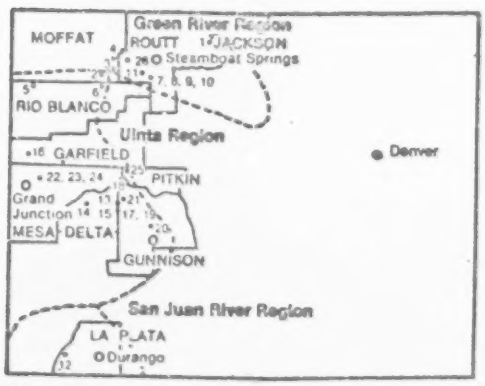
BLOCK NO.	LESSEE	LEASE NO.	ACRES	COUNTY	TYPE OF RESERVES	RECOVERABLE RESERVES *	BTU/LB	SULFUR %	ASH %	THICKNESS (Feet) *	OVERBURDEN	DIP (Degrees)
30	AMCA Coal Leasing	C030472	120.0	Jackson	U&S	> 1	8,738	0.32	14.3		15-148	12
31A&B	Kemmerer Coal Co.- 50%; Consolidation Coal Co. 50%	C0105299	560.0	Jackson	U&S	> 15	9,010	0.50	6.9		---	---
31C	" "	C0105300	1680.0	Jackson	U&S	> 15	9,010	0.50	6.9		---	---
31D	Kemmerer Coal Co.- 50%; Consolidation Coal Co. 50%	C0123177	1700.92	Jackson	U&S	> 15	9,010	0.50	6.9		---	---
32	Wyoming Fuels (assigned from Monolith Portland Cement)	D057166	172.75		U	> 1	9,917	0.34	5.0		150	---
33	Evelyn Welch & Shirley Eiggins	D043937	120.25	Garfield	U	< 1	12,865	2.35	7.1		---	45

BLOCK NO.	LESSEE	LEASE NO.	ACRES	COUNTY	TYPE OF RESERVES	RECOVERABLE RESERVES *	BTU/LB	SULFUR %	ASH %	THICKNESS (Feet) *	OVERBURDEN	DIP (Degrees)
34	Sheridan Enterprises	C0125436	2446.19	Garfield	U	>100	10,010-11,380	0.48-0.53	16.5		87-1117	3
	Sheridan Enterprises	C0125437	2357.46	Garfield			10,010-10,153	0.48-0.53	16.5		80-595	3
	Sheridan Enterprises	C0125438	2560.0	Garfield			11,380	0.48	16.5		---	3
	Sheridan Enterprises (McClain Canyon)	C0125439	2482.98	Garfield			11,380	0.48-0.53	16.5		102-233	3
	Sheridan Enterprises (Munger Canyon)	C0125515	2559.98	Garfield			10,010-10,152	0.48-0.53	16.5		---	3
	Sheridan Enterprises	C0125516	2522.72	Garfield			11,380	0.5	10.8		---	3
35	Beldon Enterprises Colby-Red Canyon Inc. Plan	D036906	41.29	Delta	U	24	11,100	0.40	5.1		---	---
36	Utah International (Green Valley - inactive)	D055156	173.70	Delta	U	<15	11,100	0.50	5.1		---	---
37	Harry L. & Opal Weaver	C069942	80.0	Gunnison	U	0.3	12,440	0.50	5.5		---	3

BLOCK NO.	LESSEE	LEASE NO.	ACRES	COUNTY	TYPE OF RESERVES	RECOVERABLE RESERVES *	BTU/LB	SULFUR %	ASH %	THICKNESS (Feet)*	OVERBURDEN	DIP (Degrees)
38	Kemmerer Coal Co.	C01200	2240.54	Gunnison	U	>15	9,410	0.40	8.4		---	---
	Kemmerer Coal Co.	C0120078	2000.00	Montrose			9,410	0.40	8.4		---	---
	Kemmerer Coal Co.	C0120079	2560.00	Montrose			9,410	0.40	8.4		---	---
	Kemmerer Coal Co.	C0120080	1600.25	Montrose			9,410	0.40	8.4		---	---
	Kemmerer Coal Co.	D038385	360.0	Montrose			9,410	0.40	8.4		---	---
	Kemmerer Coal Co.	C0120077	1241.93	Ouray			9,410	0.40	8.4		---	---
38B	Kemmerer Coal Co.	C012076	2320.0	Ouray	U	<15	9,410	0.40	8.4		---	---
39	Albert Martinez	P058043	40.0	LasAnimas	U	<1	13,660	0.50	9.6		---	---
40	CF&I Steel Co.	C067	961.92	LasAnimas	U	>15	13,000	0.70	10.8		---	---

BLOCK NO.	LESSEE	LEASE NO.	ACRES	COUNTY	TYPE OF RESERVES	RECOVERABLE RESERVES *	BTU/LB	SULFUR %	ASH %	THICKNESS (Feet) *	OVERBURDEN	DIP (Degrees)
41	Peabody Coal Co.	C0112685	640.0	Elbert	S	>15	7,100	0.8-0.9	9.8		8-41	2
	Peabody Coal Co.	C0112686	640.0	Elbert								
	Peabody Coal Co.	C0112687	643.68	Elbert								
42	Peabody Coal Co.	C0126477	760.0	Elbert	S	<15	7,100	0.8-0.9	9.8		8-41	2

COAL MINES ON FEDERAL LANDS IN COLORADO



Map locations

1 - Canadian Strip
2 - Colowyo
3 - Eagle Nos. 5, 9
4 - Trapper
5 - Deserado ★
6 - Meeker Area
7 - Apex No. 2
8 - Edna
9 - Trout Creek
10 - Energy Fuels Nos. 1, 2
11 - Johnnies ★
12 - Seneca, 2W
13 - National King Coal
14 - Orchard Valley
14 - Red Canyon No. 2★
15 - Somerset
15 - Blue Ribbon
16 - Loma Complex ★
17 - Bear
17 - Mt. Gunnison ★
18 - Coal Basin
19 - Hawksnest East & West
20 - Ohio Creek No. 2 ★
21 - Windjammer No. 1 ★
22 - Cameo Nos. 1, 2
22 - Roadside
23 - Coal Canyon
24 - Cottonwood Creek
25 - Snowmass ★
26 - Marr

SOURCE: Office of Technology Assessment.

★ Undeveloped Federal Leaseblock

EXISTING FEDERAL COAL LEASES, PRLAS, AND NEW LEASE TRACTS IN THE GREEN RIVER REGION

COLORADO COAL LEASES

REF NO	LESSEE	SERIAL NUMBER	OTA Block No.
40	AMCA Coal leasing, Inc.	C-051376	1
41	Consolidated Coal Co.	C-245	13
42	"	C-1546	14
43	"	C-1545	
44	Colowyo Coal Co.	C-034365	
45	Empire Energy Corp.	C-0126480	
46	"	C-056298	
47	"	C-0127865	
48	Energy Fuels Corp.	C-052547	
49	"	C-22676	
50	"	C-16264	
51	"	C-20900	
52	"	C-22644	
53	"	C-26913	
54	Gulf Oil Corp.	C-021601	
55	"	C-053710	
56	"	C-041478	
57	"	C-033327	
58	Ferne M. James	C-064416	3
59	Prosper Lombardi, Jr.	C-23396	4
60	Peabody Coal Co.	C-0125957	5
61	"	C-088199	8
62	"	C-086654	7
63	"	C-0114093	6
64	Ruby Construction Co.	C-051698	9
65	Reliable Coal and Mining	C-047201	not shown
66	Sunland Mining Corp.	C-0127-92	
67	Sewanee Mining Co., Inc.	C-044240	
68	Utah International Inc.	C-079641	
69	Consolidated Coal Co.	C-093716	
70	"	C-093715	
71	"	C-093714	
72	"	C-093713	
73	Energy Fuels Corp.	C-081330	
74	"	C-0128433	
75	Franklin Real Estate Co.	C-012894	2
76	Materials Service Corp.	C-081251	
77	"	C-081258	
78	Moon Lake Electric	C-023703	not shown
79	Riebold and Chapman	C-028875	
80	Sheridan Enterprises Inc. →	C-052546	10
81	Sunland Mining Corp.	C-046544	
82	ewanee Mining Co., Inc.	C-076713	11
83	Utah International Inc.	C-813	
84	"	C-07519	
85	"	C-0123476	16
86	"	C-07518	

COLORADO PREFERENCE RIGHT LEASE APPLICATIONS

87	Consolidated Coal Co.	C-0126998
88	"	C-0126997
89	"	C-0126999
90	P. Jensen and K.W. Miller	C-4275
91	Moon Lake Electric	C-8424
92	"	C-8425
93	Riebold and Chapman	C-0125368
94	Reliable Coal and Mining	C-0126669
95	Utah International Inc.	C-0123475
96	Kemmerer Coal Co.	C-3606
97	"	C-3605
	"	

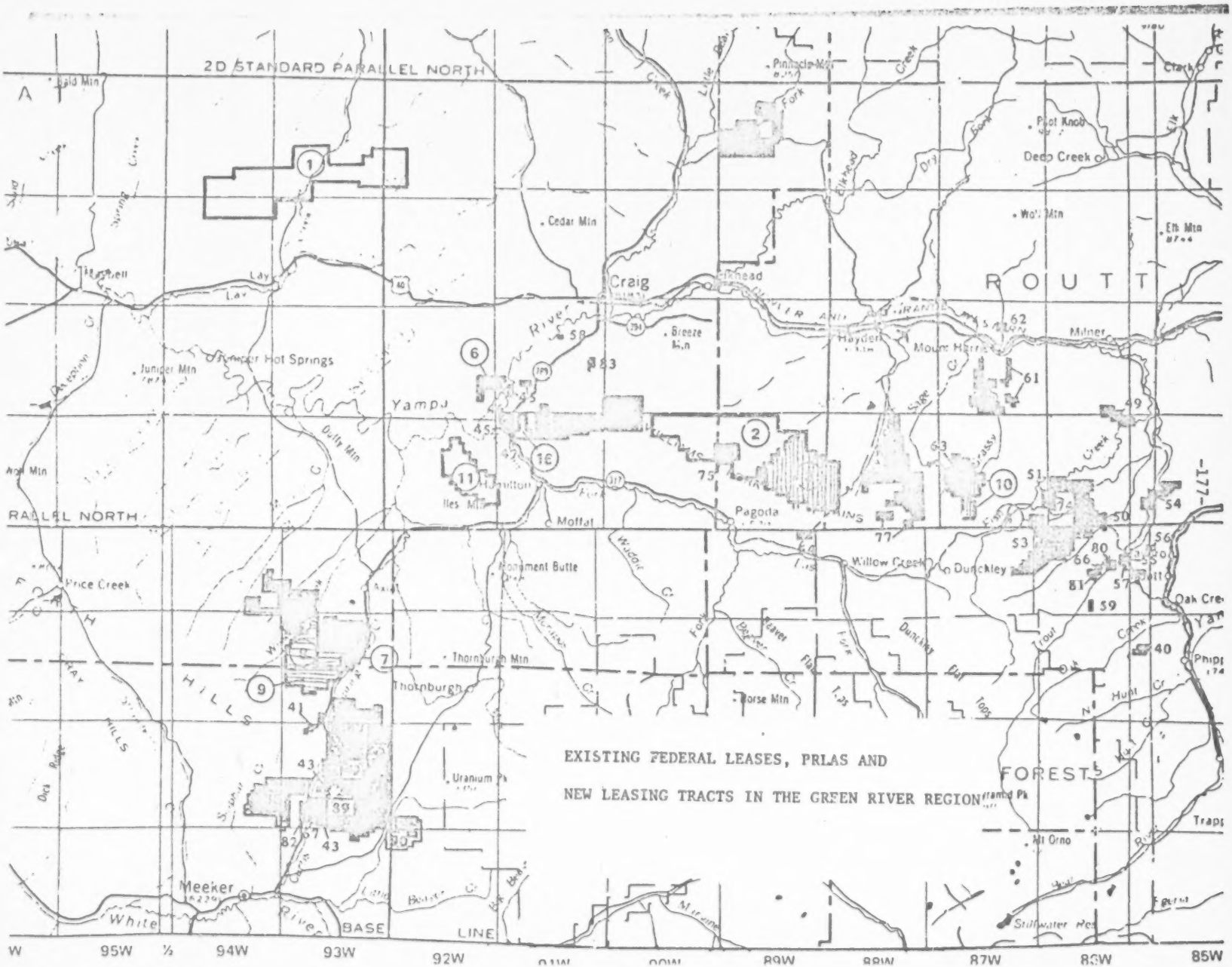
NEW LEASING TRACTS

Map No.	Tract
1	Lay Creek
2	Williams Fork Mtn
3	Hayden Gulch
4	Pinnacle
6	Bell Rock
7	Danforth Hills No. 1
8	Danforth Hills No. 2
9	Danforth Hills No. 3
10	Grassy Creek
11	Iles Mountain
16	Empire

Delineated Tract

1981 Sale

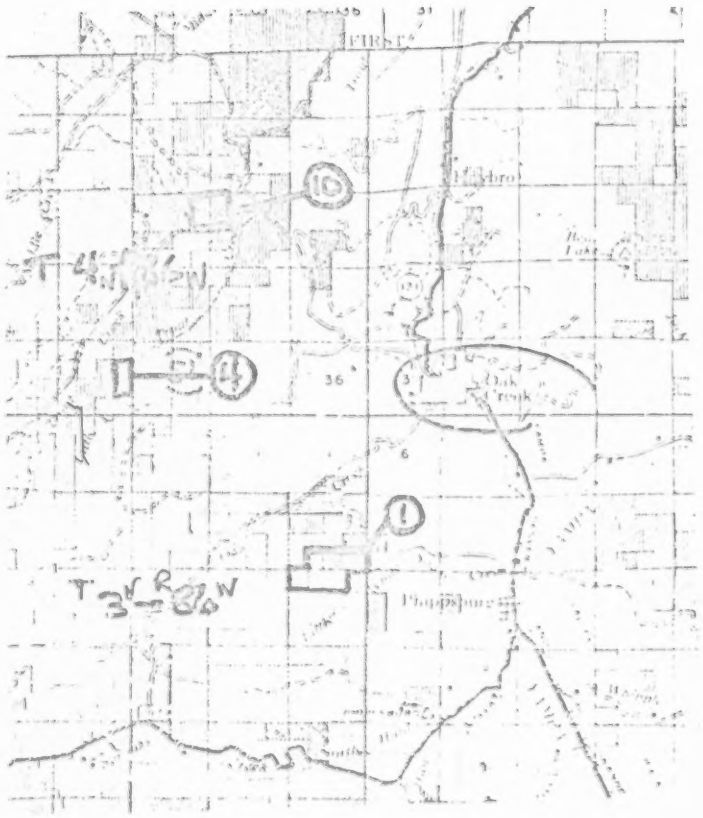
1982 Sale

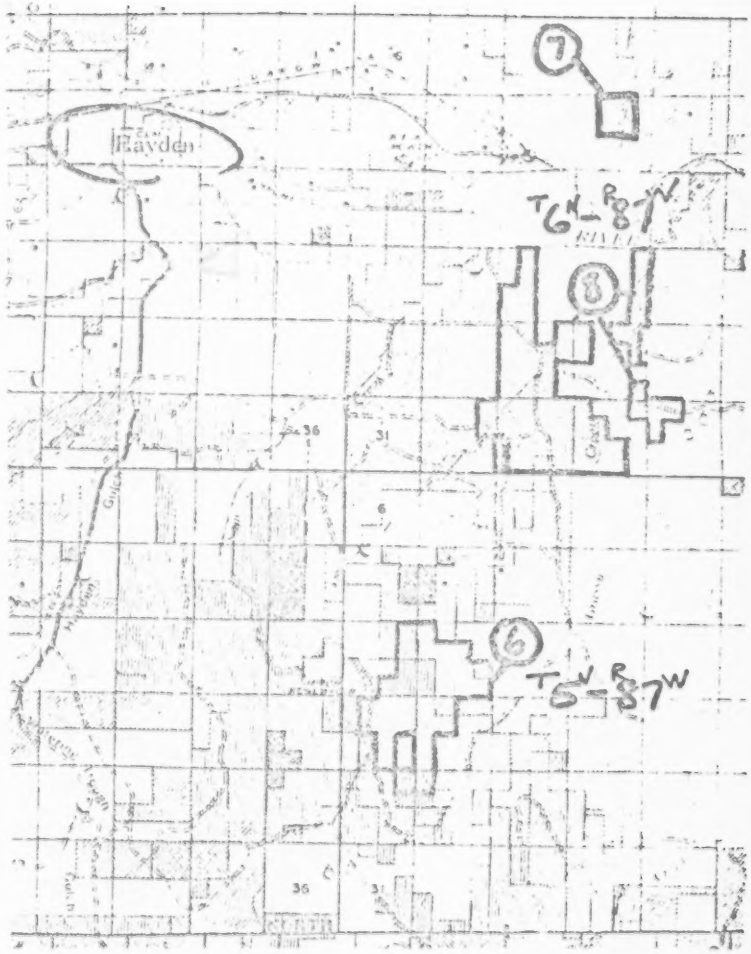

2D STANDARD PARALLEL NORTH
RALLEL NORTH
Craig
Hayden
Milner
Yampa
Oak Creek
Meeker
Thornburgh
Thornburgh Mtn
Pagoda
Moffat
Willow Creek
Duncklee
Price Creek
Monument Butte
Uranium Pk
Horse Mtn
Mt Orno
Deep Creek
Cedar Mtn
Juniper Mtn
Iles Mtn
Breeze Mtn
Mount Harris
Pilot Knob
Elk Mtn
Trappers
Stillwater Res
ROUTT
FOREST
HILLS
White River
BASE LINE
EXISTING FEDERAL LEASES, PRLAS AND
NEW LEASING TRACTS IN THE GREEN RIVER REGION
W
95W
½
94W
93W
92W
91W
90W
89W
88W
87W
86W
85W

APPENDIX D

DETAIL MAPS OF UNDEVELOPED LEASE BLOCKS

IN COLORADO





BLM QUAD

IN 0 1 6 miles

BLOCKS # 1,4,6-8,10

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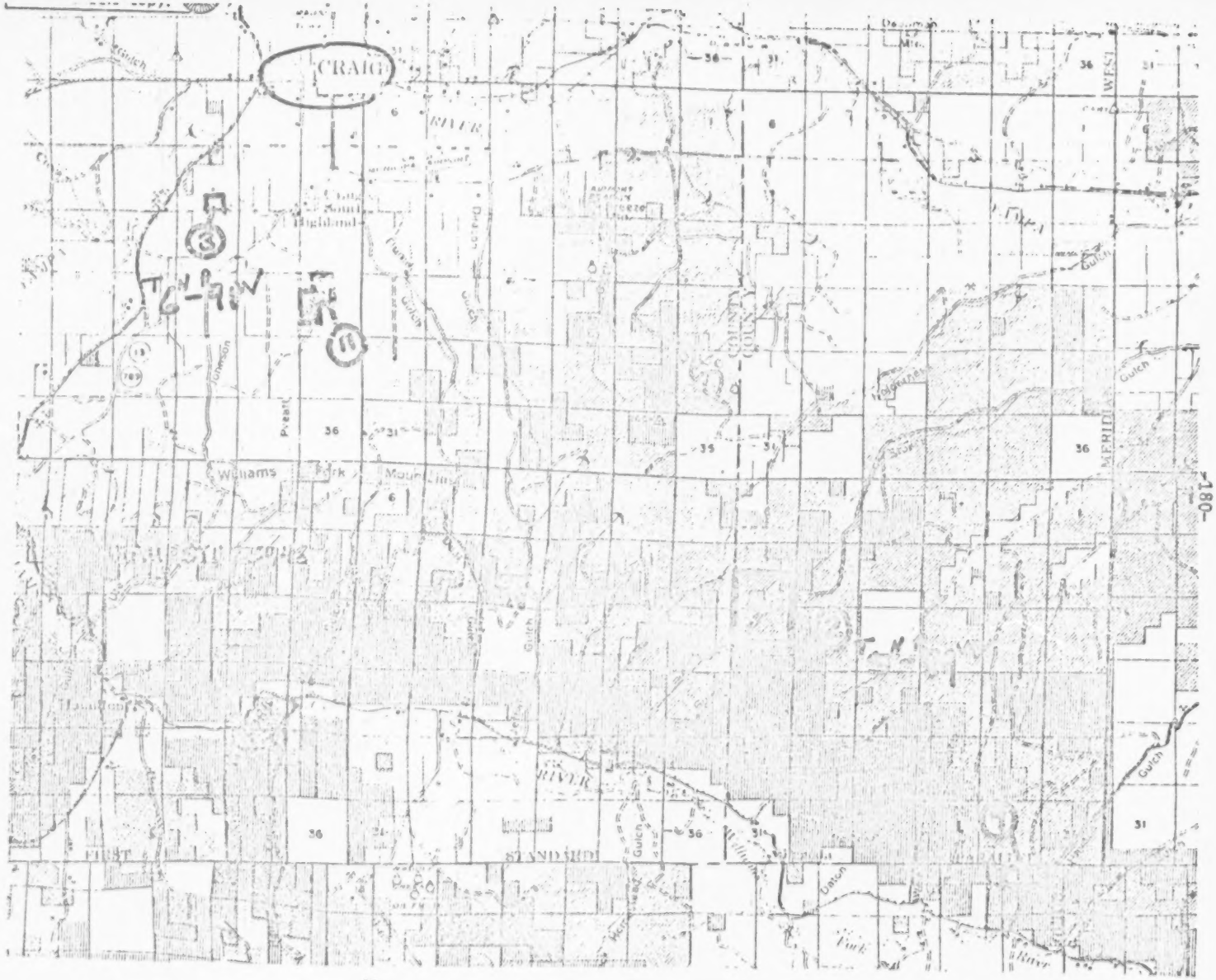
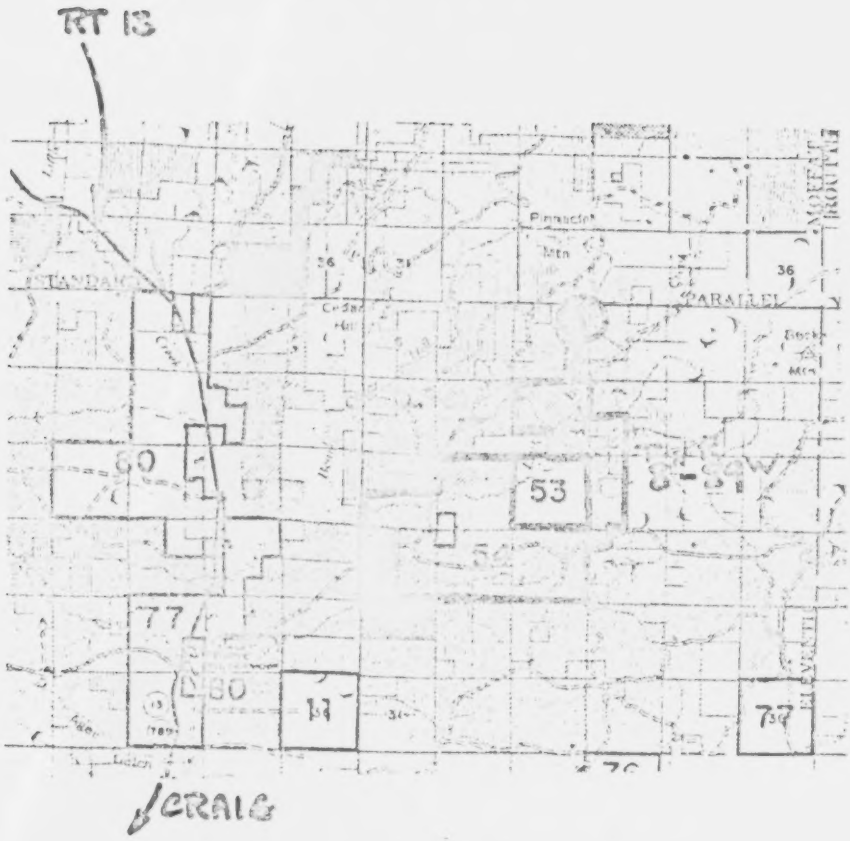


BIM QUAD

PLOCKS : 2,3,9,11

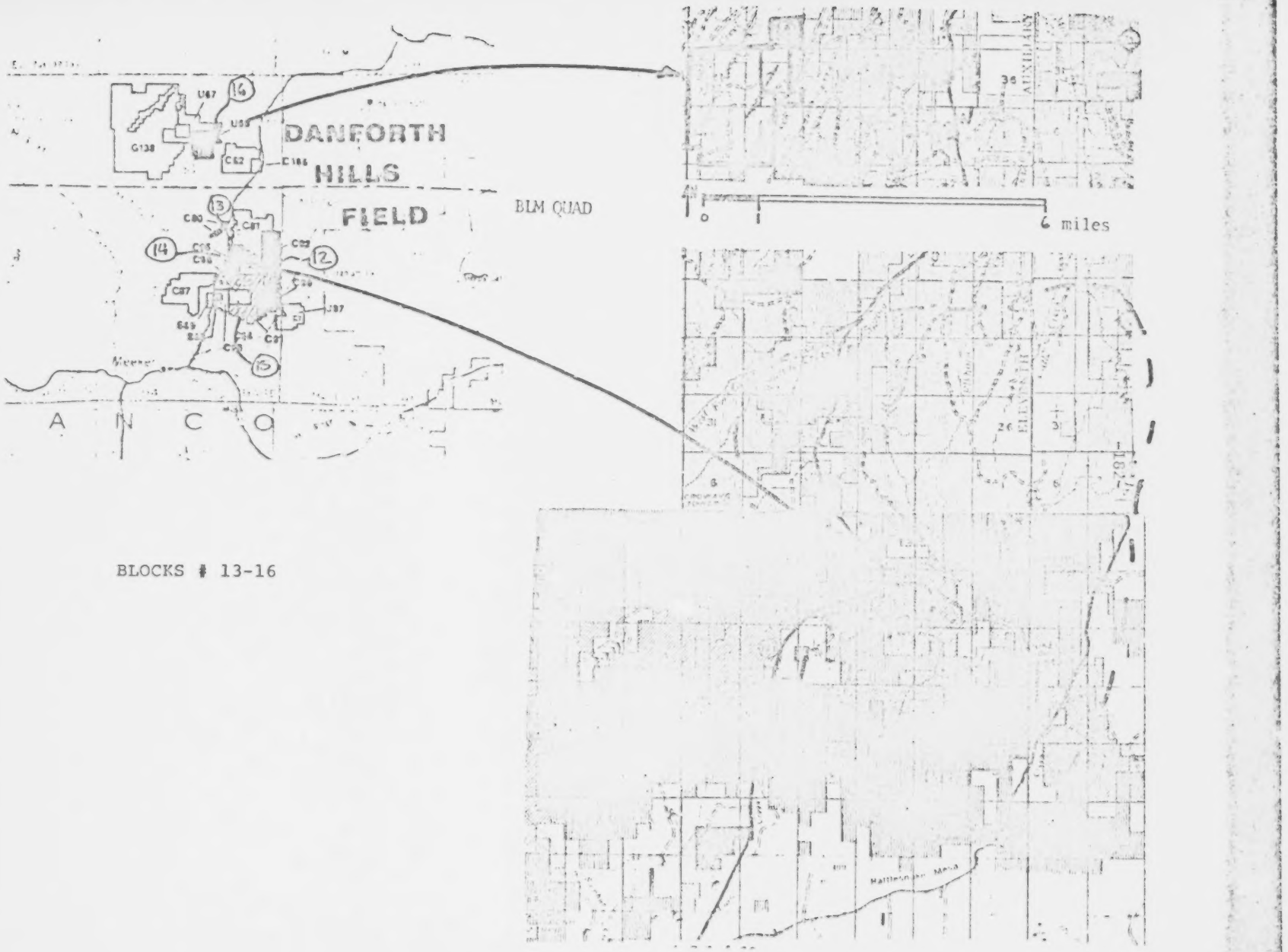


BLM QUAD

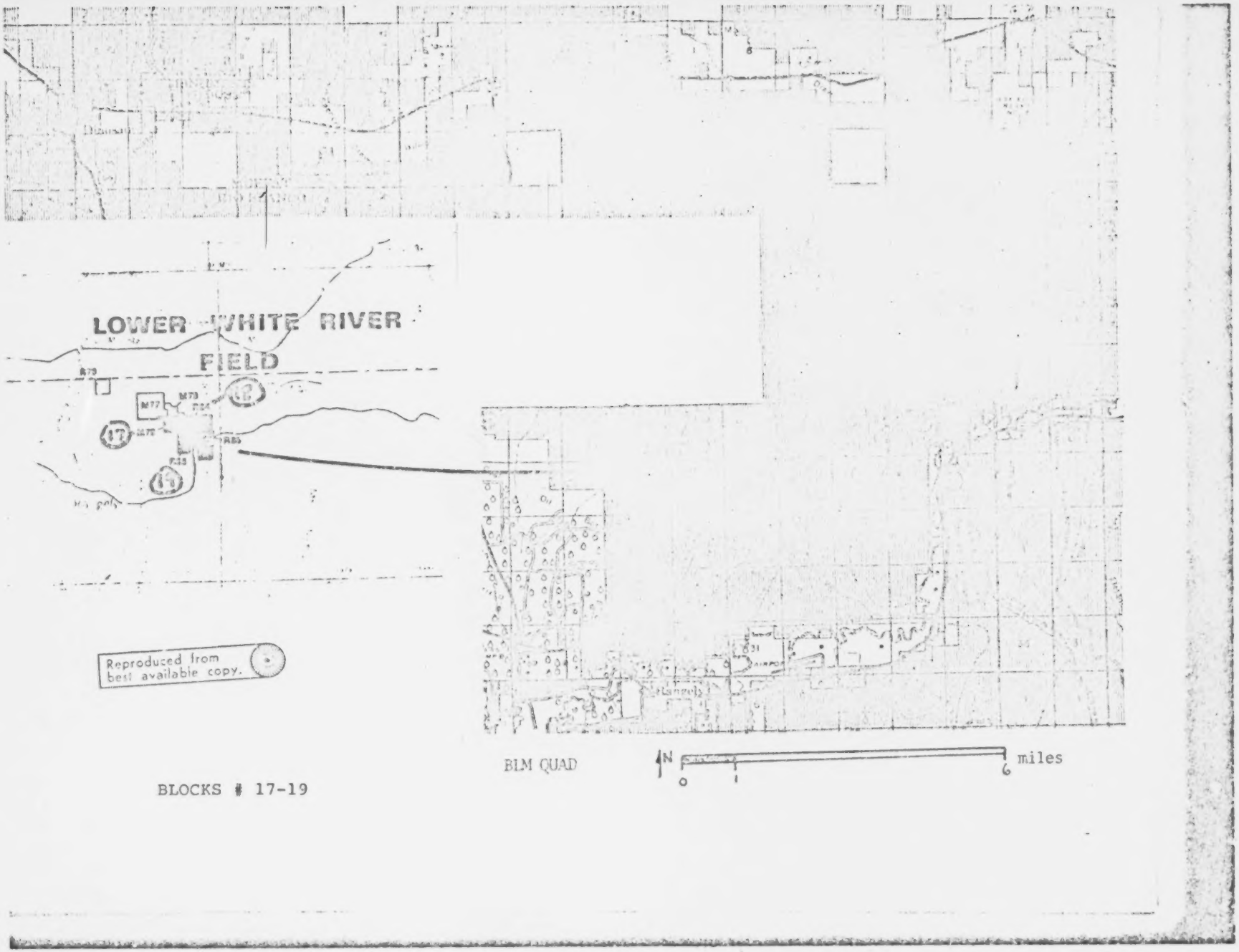
N

0 1 6 miles

BLOCK # 5



BLOCKS # 13-16



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BLM QUAD

BLOCKS # 17-19

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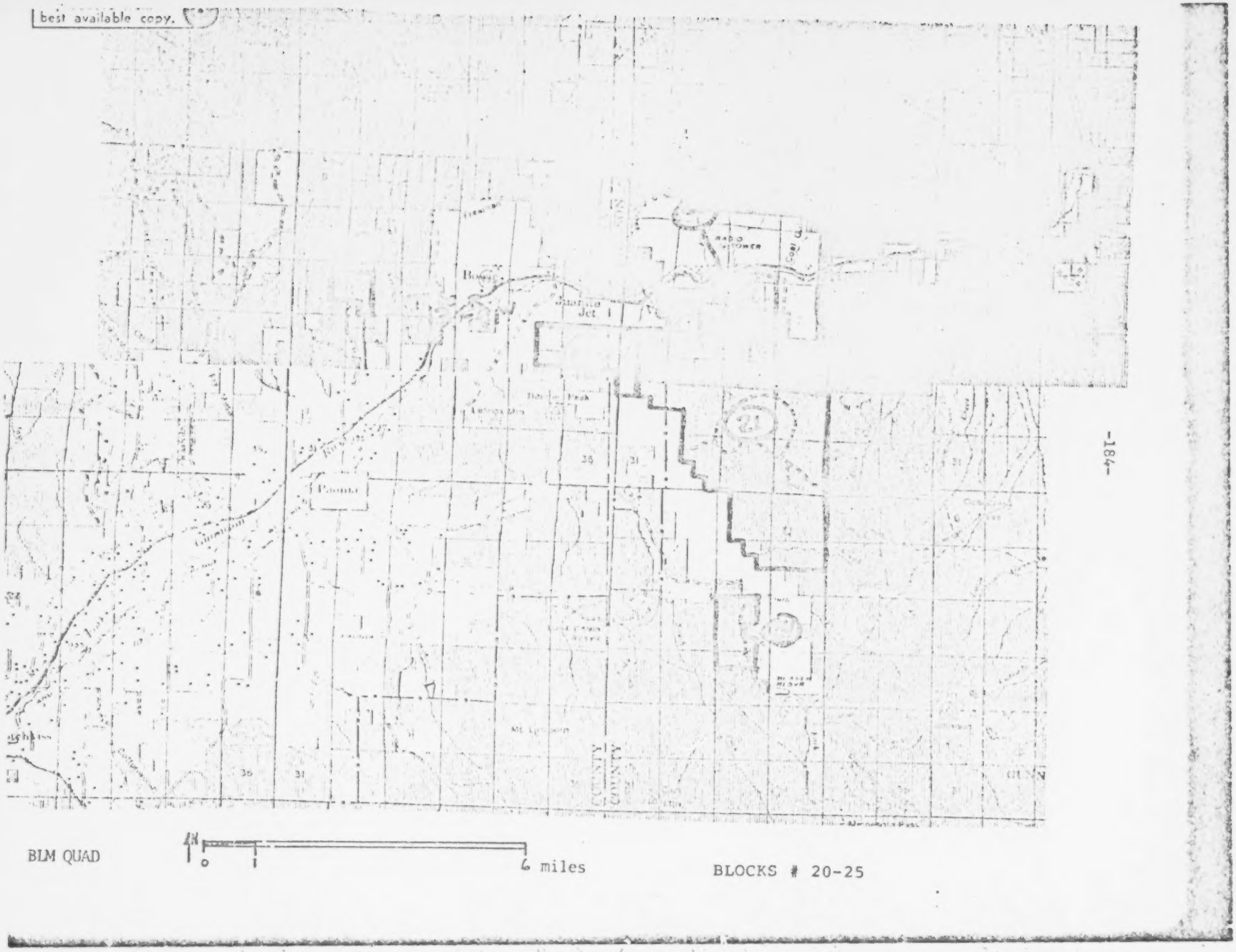


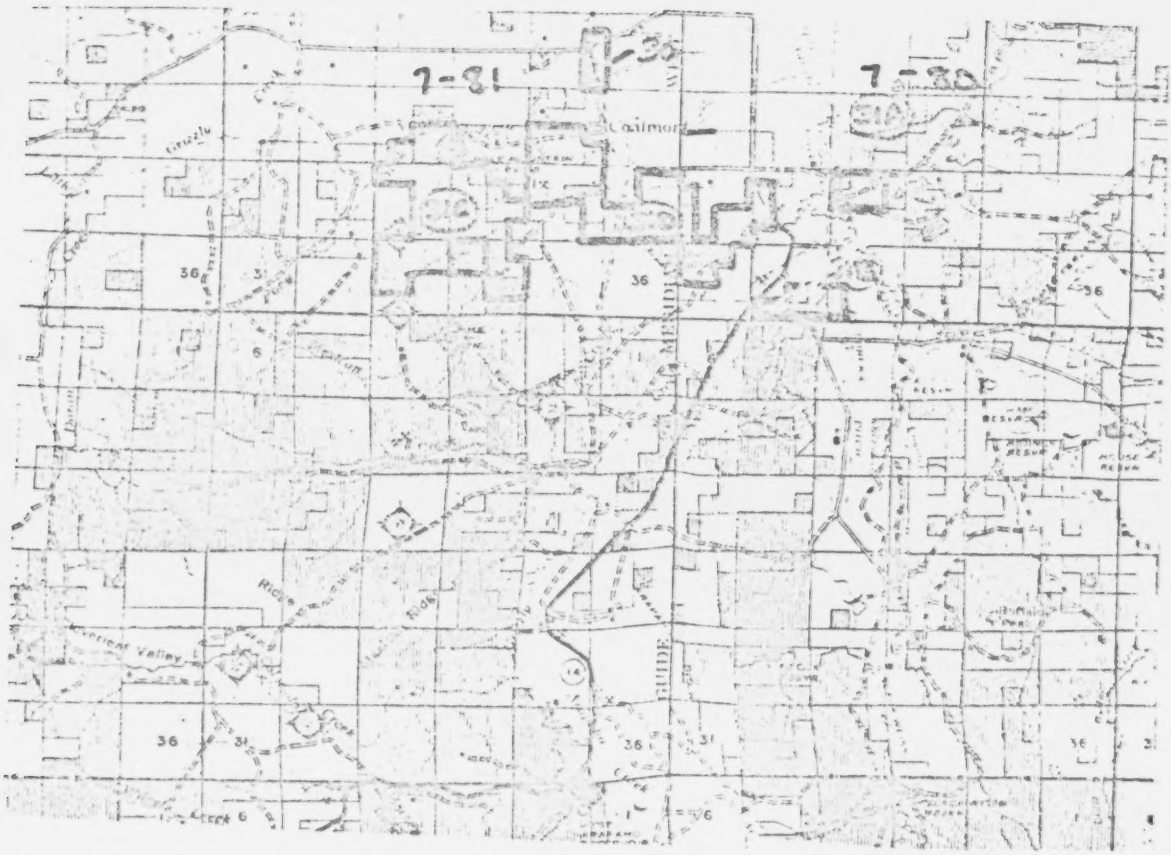
BLM QUAD

0 1 6 miles

BLOCKS # 20-25

BLM QUAD
0
1
6 miles
Carbondale
PITKIN
FOREST
COUNTY
LARKSPUR
TUNNELS
RIDGE
TRAIL
EAST
Welch
36

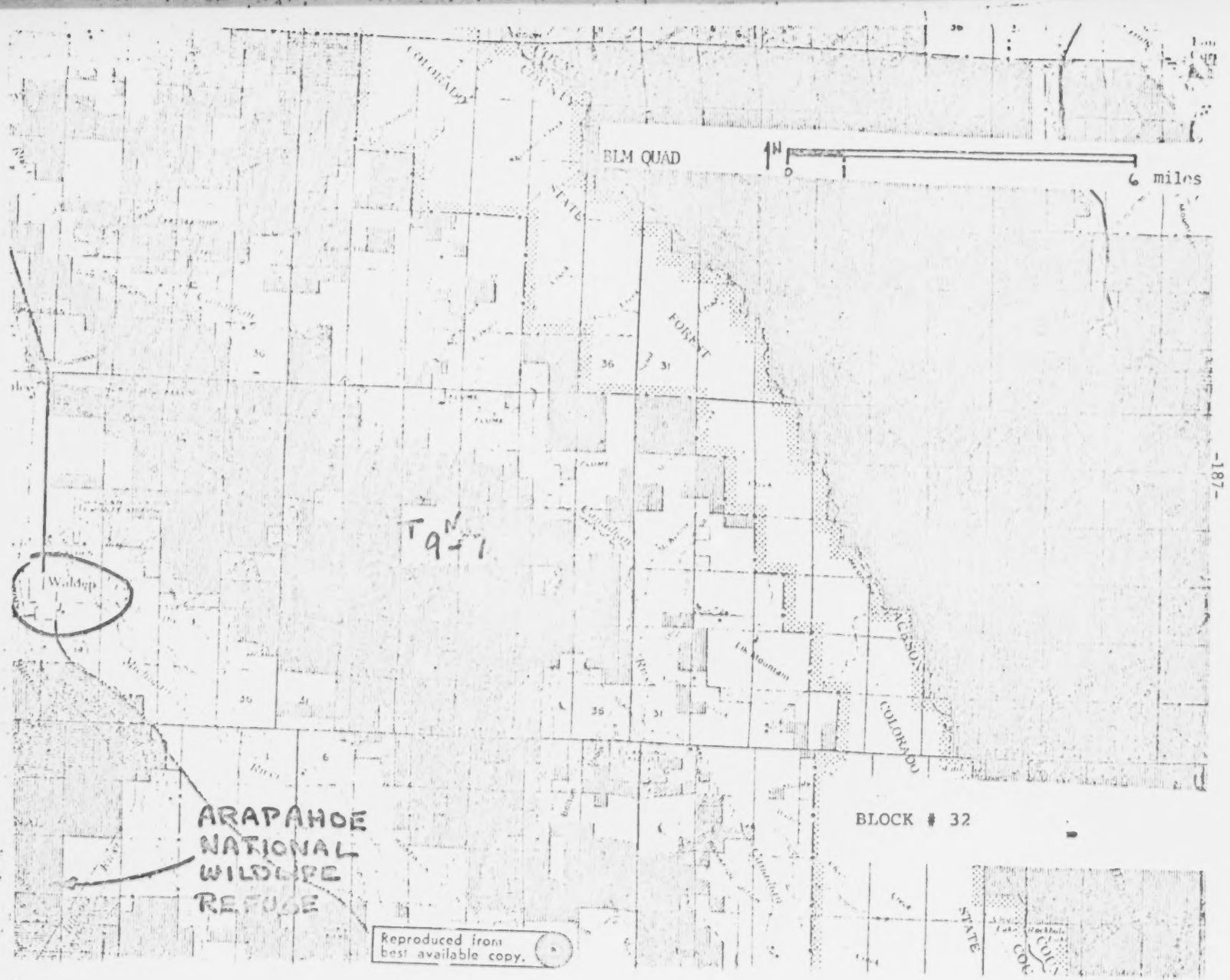
BLOCKS # 26-29



BLM QUAD

N 0 1 6 miles

BLOCKS #30, 31ABC&D



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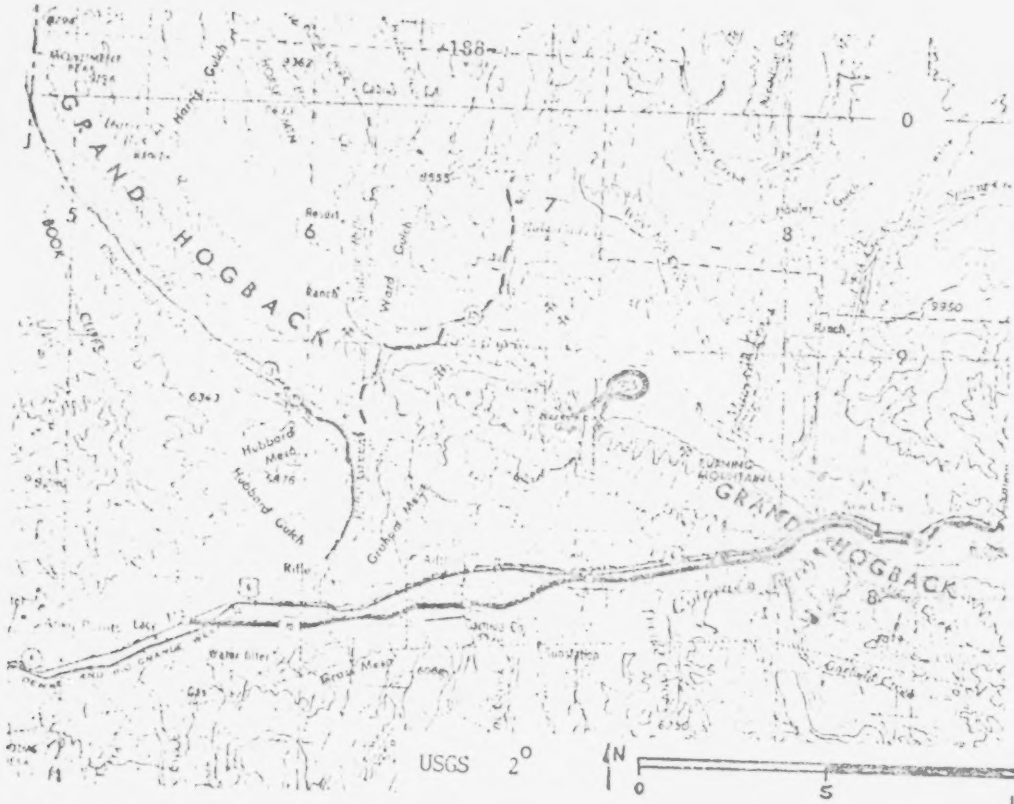
GRAND HOGBACK
Hubbard Mesa
Hubbard Gulch
Grubert Mesa
Rifle
Ward Gulch
Ranch
Water Tank
Cutler Creek
Colorado River
GRAND HOGBACK
USGS 2°
N
0
5
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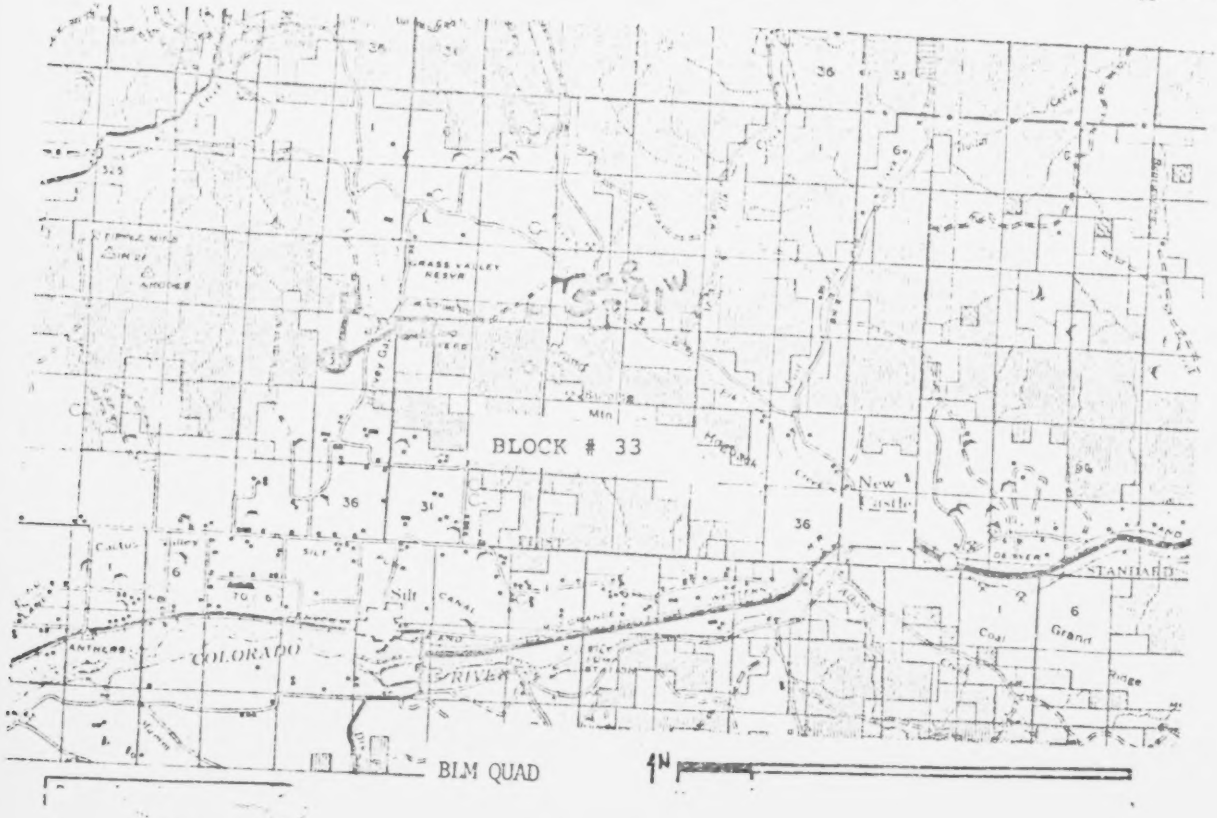
mile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Canal
COLORADO
RIVER
Coal
Grant
STANLEY
BLM QUAD
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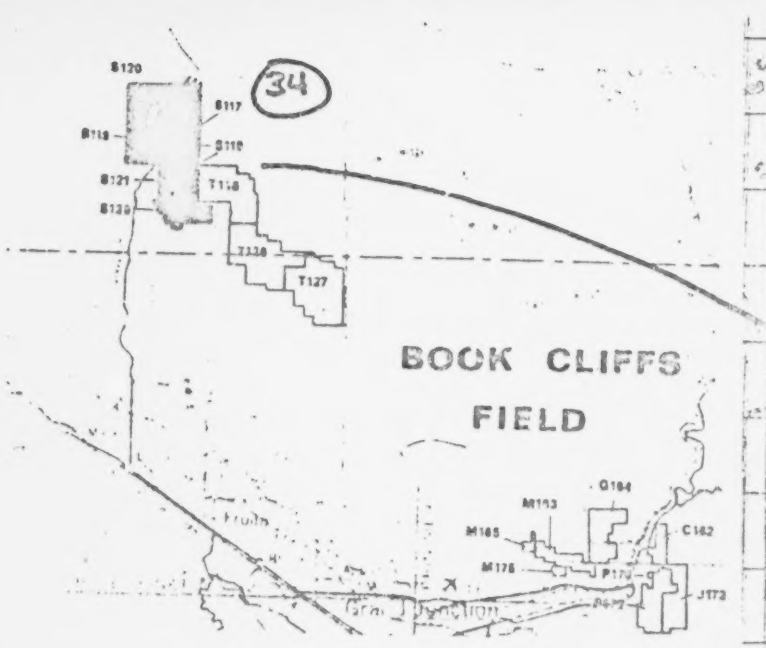

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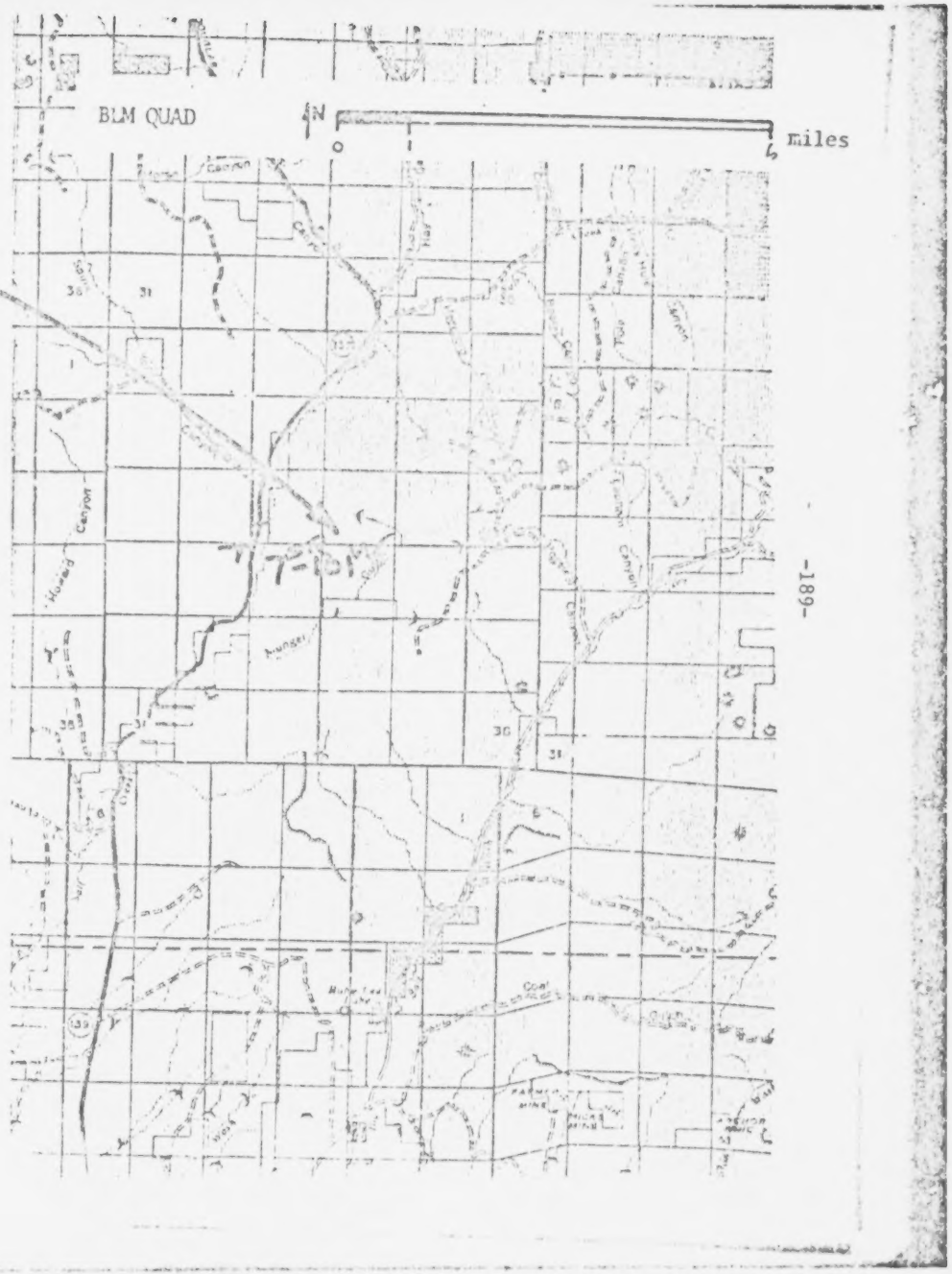

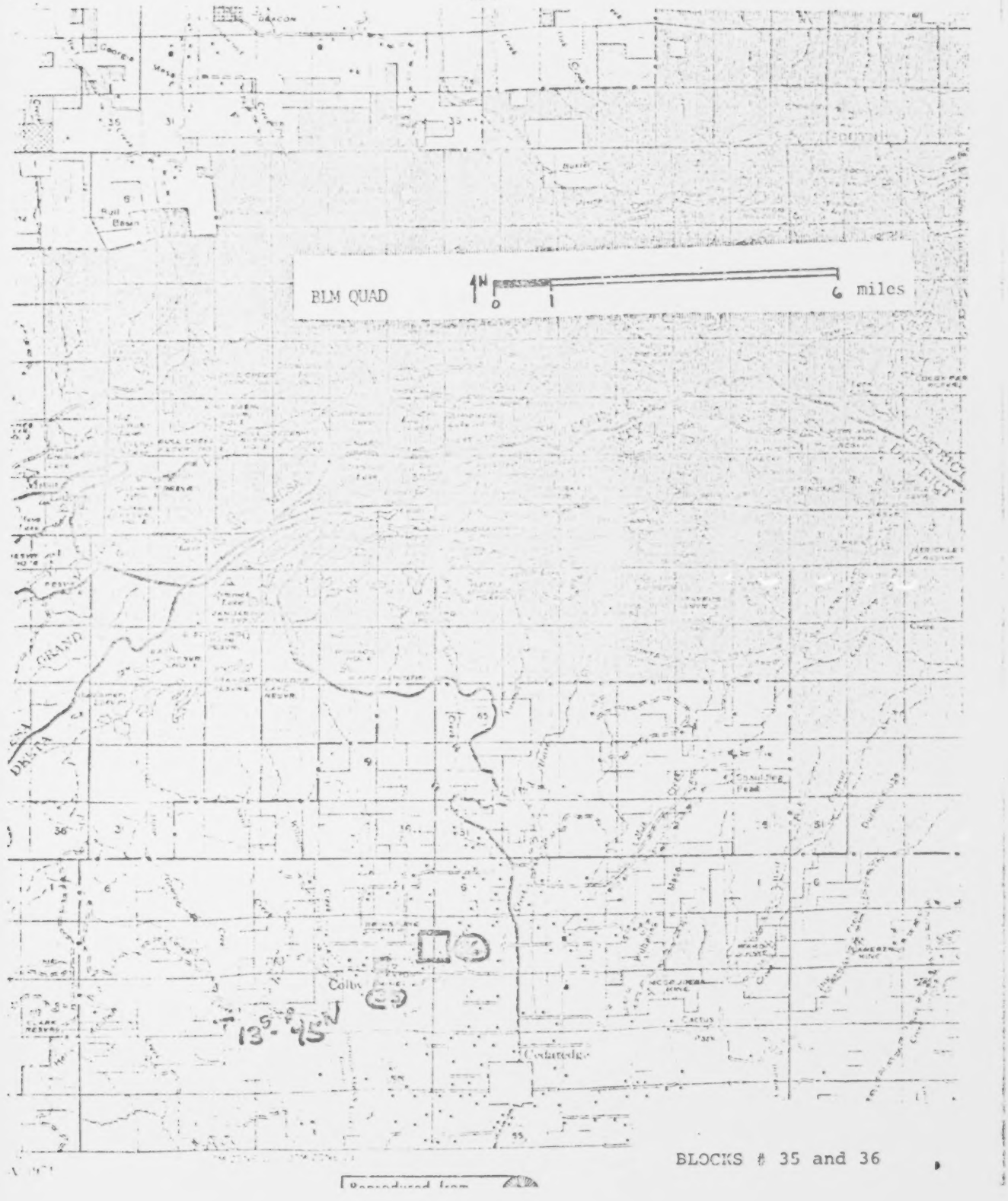

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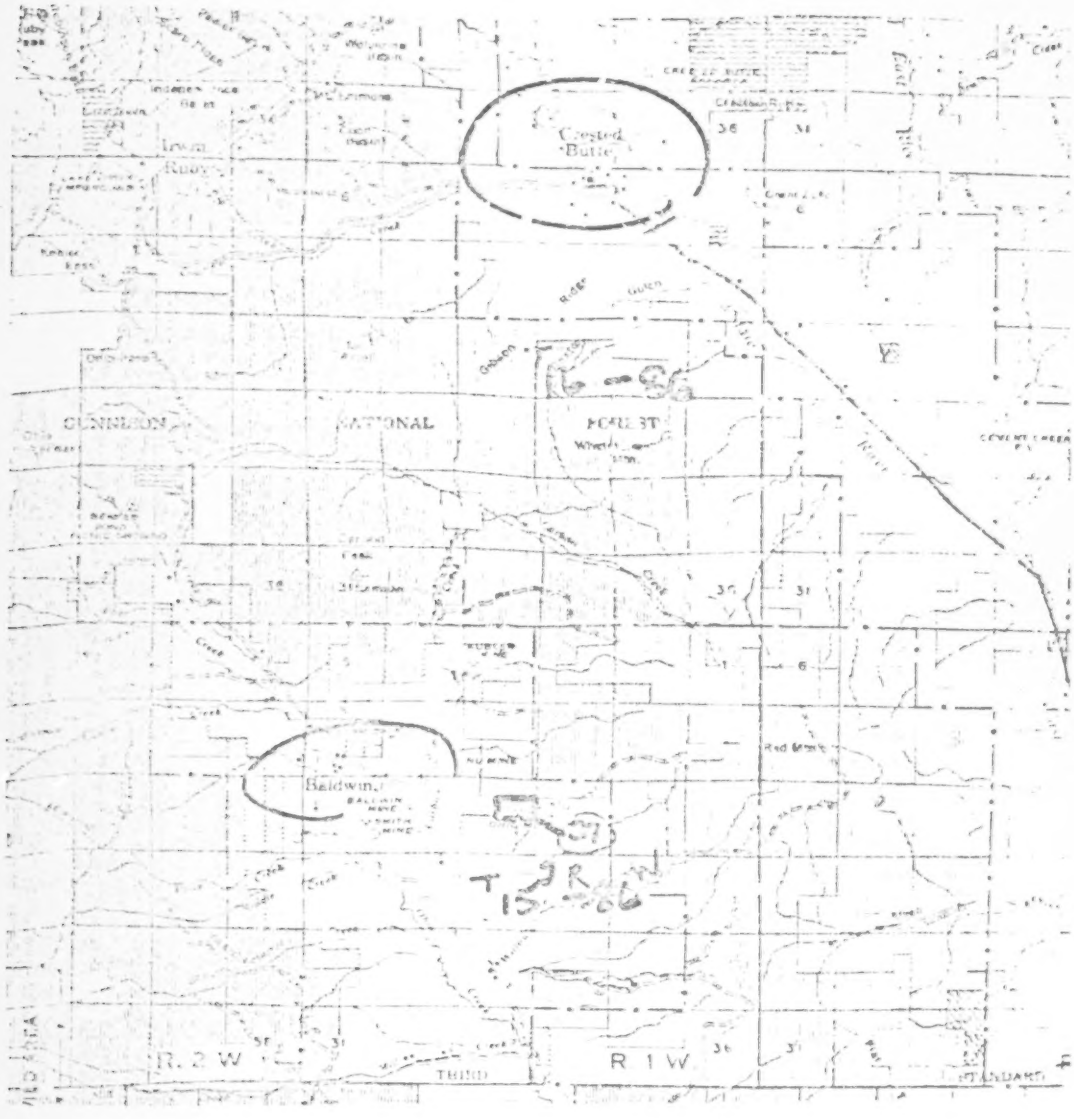

BLM QUAD

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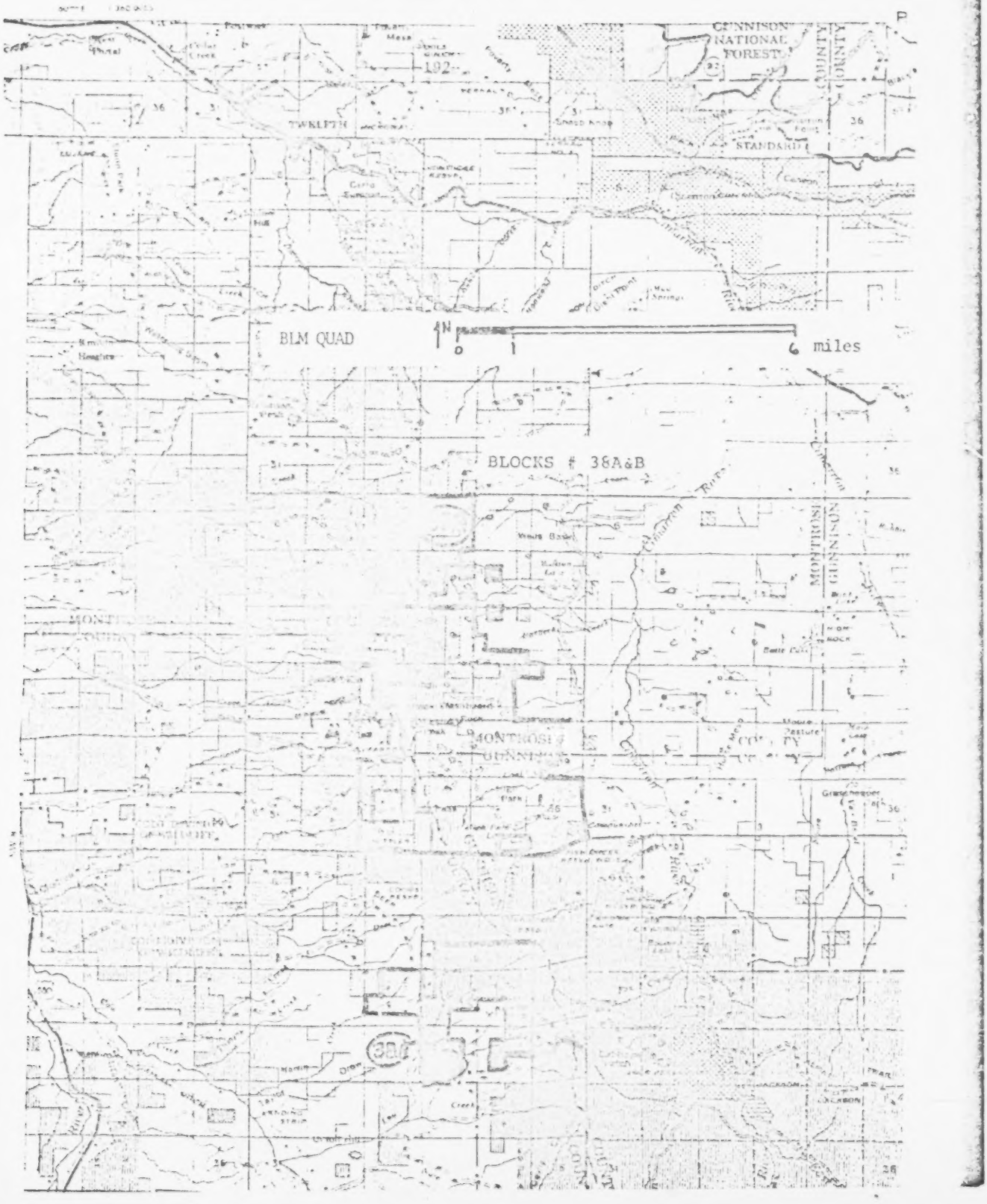
BLOCK # 37


BLM QUAD
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BLOCKS # 38A&B
GUNNISON NATIONAL FOREST
MONTROSE
GUNNISON
STANDARD
TWIN PEAKS
Gunnison River
Willow Basin
Beaver Creek
Grass Mesa
Pasture
Cr.
Ty
Park
Creek
Drive
Trail
Jackson
Cabin
Ditch
Spring
Reservoir
Airport
Hill
Mountain
Canyon
Mesa
Forest
Road
Lake
Camp
Ranch
Meadow
Rock
Valley
Fork
Gulch
Basin
Pass
Peak
Ridge
Slope
Flat
Bench
Butte
Cliff
Cave
Spring
Well
Tank
Fence
Gate
Bridge
Dam
Power
Line
Pipeline
Road
Trail
Drive
Lane
Court
Place
Circle
Boulevard
Avenue
Street
Highway
Interstate
Route
Exit
Entrance
Ramp
Overpass
Underpass
Intersection
Roundabout
Traffic
Light
Sign
Stop
Yield
Speed
Limit
Crosswalk
Sidewalk
Curb
Gutter
Drainage
Culvert
Ditch
Swale
Berm
Shoulder
Median
Island
Turn
Lane
Merge
Exit
Entrance
Ramp
Overpass
Underpass
Intersection
Roundabout
Traffic
Light
Sign
Stop
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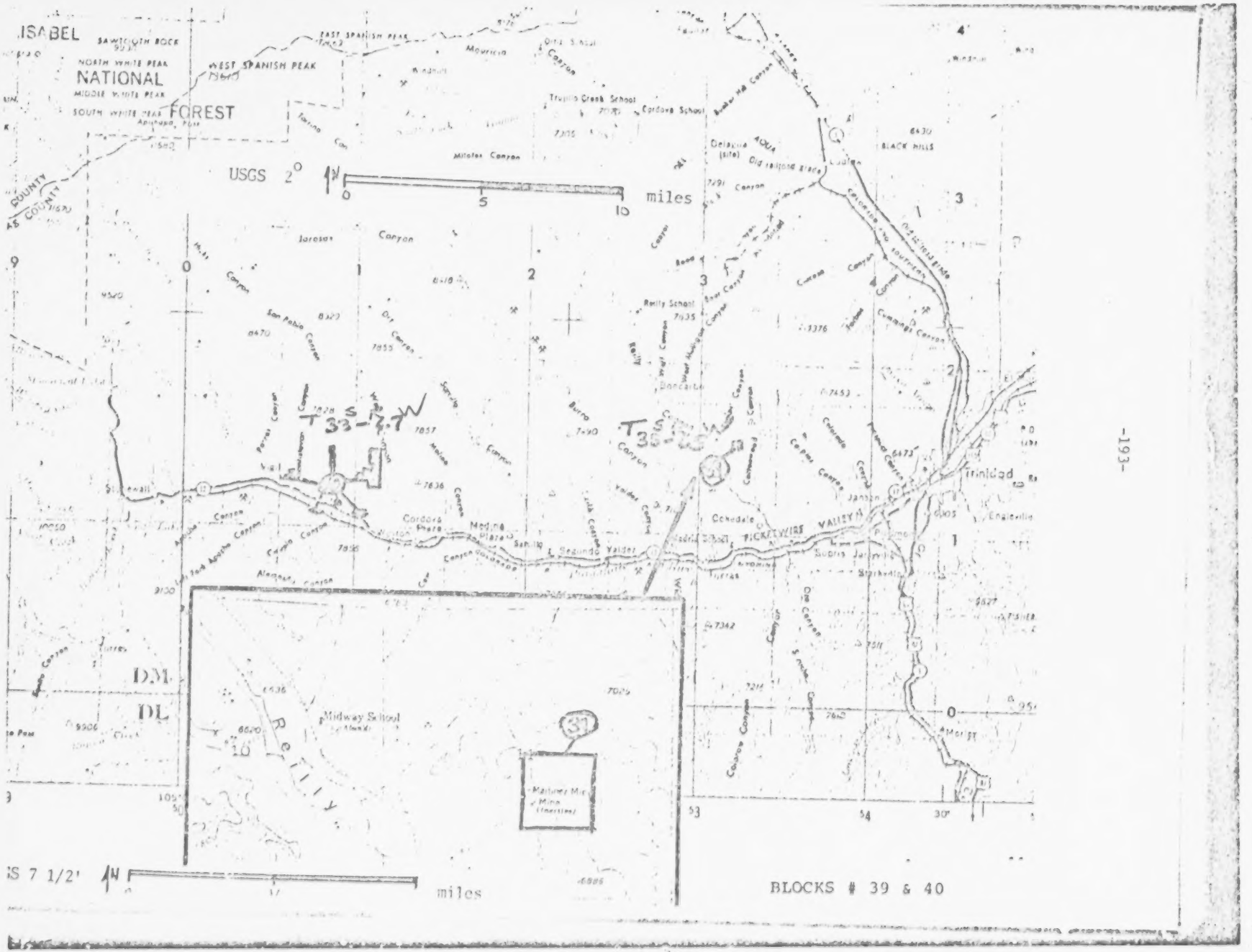
ISABEL
NATIONAL
FOREST
WEST SPANISH PEAK
USGS 2°
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miles
T 33 S - R 67 W
T 35 S - R 67 W
Trinidad
Cordova School
Midway School
Midway Mine
DM
DL
BLOCKS # 39 & 40
miles

Reproduced from best available copy.

USGS 2° N 0 5 10 miles

BLOCKS # 41 and 42

OTA WORKING PAPER A

PART II

MARKET FACTORS AND PRODUCTION CONTINGENCIES DETERMINING THE PRESENT AND FUTURE DEMAND FOR COLORADO COAL

Prepared for

Colorado Energy Research Institute
3000 Youngfield Street, Suite 153
Lakewood, Colorado 80215

Prepared by

Joan E. Martin
Fred C. Hart Associates, Inc.

October 1980

OTA WORKING PAPER

This report is an OTA working Paper which was used in the preparation of OTA's final assessment report. OTA makes these working papers available for the use of readers desiring a more detailed or technical discussion of an issue than can normally be accomodated in our final report. As an OTA working paper. this report has not been reviewed or approved by the Technology Assessment Board. The findings and conclusions expressed in the report are those of the authors and do not necessarily reflect the views of OTA, the coal leasing project advisory panel or the Technology Assessment Board.

The Colorado Energy Research Institute was created in 1974 as part of the Colorado School of Mines to provide independent and timely information to the executive and legislative branches of Colorado government on energy-related matters. COLORADO ENERGY's basic function is to help State policymakers anticipate and plan for the many ways the development, management and use of energy will affect the lives of Colorado citizens. To this end, COLORADO ENERGY, through its program of research, explores physical, technological, biological, economic, social and political impacts that can result from energy-related activities.

Requests for studies are made by the chairpersons of the energy committees of the Colorado General Assembly, by the Governor and members of his cabinet, and by COLORADO ENERGY's advisory council.

COLORADO ENERGY currently has studies underway in four general areas; energy resource development; energy conservation; energy impact analysis and mitigation; and energy information.

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OVERVIEW

This report discusses the market factors and contingencies which contribute to present and future demand and production of Colorado coal.

Colorado coal is mined by almost every mining method, consists of deposits of almost every rank of coal, is found in each geographical region of the State and has characteristics desirable for commercial, residential, and utility use. As a result, the market factors and production contingencies are diverse.

A number of analyses with high scenarios have predicted that Colorado could experience an accelerated rate of coal production over the next decade, 1980-90. An historical review of Colorado coal production may also encourage expectations of accelerated mining activity, as growth rates tripled during the late 1970s. However, a mine-specific study and survey suggests that coal production in Colorado will experience more moderate increases during the 1980s than some have anticipated. Colorado mines produced 18.1 million tons of coal in 1979.

Based on data developed for this report, total annual coal production in Colorado is projected to be:

24.6 - 25.9 million tons in 1986
26.0 - 34.8 million tons in 1991

The first number of the range indicates coal production projected from existing and highly probable contracts. The second number of the range represents a reasonable estimate of additional production from new foreign markets, new spot market contracts for test burns, and due diligence regulations. It was arrived at through discussion and concensus of the OTA Colorado Coal Leasing Task Force.

These projections are consistent with existing medium and low scenarios forecasted by the Department of the Interior and the Department of Energy, except that no synfuels from coal are anticipated by 1991.

Metallurgical coal will remain second in production to steam coal. Under current market conditions, production demand for metallurgical coal, all mined underground, will remain stable at 3.1 MTPY through 1991 while the production of steam coal increases. A potential variable is that the market for metallurgical coal could be severely affected by the closing of Western steel plants. If the Provo Plant in Utah is closed, production would be decreased by approximately 20 percent.

Surface mining production, which first surpassed underground mining production in Colorado in the mid-1970s, is expected to reverse its role again. It is now anticipated that underground production will surpass surface production between 1986 and 1991. The major reasons for this trend are the depletion of strippable reserves in Northwest Colorado, and the increase in underground production from both Northwest and West Central Colorado.

By mining method, the production projections are:

1986	surface	14.0 - 14.7 million tons (55 - 52%)
	underground	10.6 - 11.2 million tons (45 - 48%)
1991	surface	11.5 - 15.3 million tons (45 - 46%)
	underground	14.5 - 19.5 million tons (55 - 54%)

The most productive coal area in the State is the Yampa field in the Green River Region. There are currently 11 mines producing almost ten MTPY in the Yampa field. Production there is expected to increase to 11.5 MTPY in 1986 and drop to 8.7 MTPY in 1991. The Yampa field faces the greatest market competition (Projected production by Region and Field is detailed in Part III, page 30.).

The factors affecting Colorado coal production and markets include:

- Federal policies governing:
  - Air Pollution
  - Coal Transportation
  - Coal Management/Leasing
  - Synthetic Fuels
  - Coal Conversion
  - Nuclear Power
  - Foreign Trade
  - Reclamation
  - Energy Mobilization Board

- State policies governing:
  - Severence Taxes
  - Water Policy and Water Law
  - State Land Management
  - Regional Coal Teams
  - Administration of Federal Programs

Other coal market determinants include the lead time required to put a coal mine in full production, development of coal-related technologies, desirability of certain types of coal, electrical utilities' growth rate and the availability of trained miners.

With all these market determinants and uncertainties, it is difficult and misleading to generalize or summarize the market potential for Colorado coal. It should be recognized that there currently is overcapacity in Western coal fields. In 1979 almost 1.2 million tons of coal were stockpiled. Colorado is judged to have a production capacity from existing mines only of 37 MTPY.

The most significant factors affecting future contracts and production of Colorado coal are:

- o coal transportation;
- o synfuels from coal; and
- o foreign markets.

The most uncertain factors affecting future contract and production of Colorado coal are:

- o synfuels from coal;
- o foreign markets; and
- o industrial markets.

Research indicates that Colorado coal will continue to be used in older Colorado utilities designed for Colorado coal. Colorado coal is not being burned in the newer Eastern Slope utilities designed to burn Wyoming coal. It can be assumed that power plants under construction and proposed for the Eastern Slope will import Wyoming coal, and that power plants proposed for the Western Slope (Colorado Ute's Southwestern, Craig Unit No. 3, and Moon Lake Electric's facility) will burn Colorado coal.

Few large, long-term contracts will probably be cancelled, so out-of-State utility and industrial markets will remain. However, some options, smaller contracts, and spot market contracts have been cancelled. It is difficult to predict whether this trend will continue or reverse itself in the next ten years.

Colorado coal producers have competition from every direction. Geographically, Colorado coal is placed in the middle of the western coal deposits but on the wrong side of the mountains for present markets. As long as coal transportation plays such a significant role, it will be difficult for Colorado coal to be competitive with Wyoming, Montana, Utah, and New Mexico coals, as well as with the Midwestern coals and the Southern lignites. The trump card is the uniqueness of Colorado coals. Existing markets with older facilities needing new fuel sources and foreign markets want coal with the characteristics found in Colorado's deposits.

The Green River - Hams Fork and the Uinta coal regions have traditionally been the greatest producers of Colorado coal during the last decade. This will continue to be the case. These are the regions capable of responding to potential new markets.

Currently the markets for Colorado coal are soft, but there are several new potential markets. Research indicates that there are almost twenty significant, changing, and uncertain factors affecting these markets. It is concluded that the markets will remain soft and that production will only slightly increase through 1988. With much less certainty, it is concluded that this trend will change in the late 1980's. New markets should develop, and Colorado coal production will increase at greater rates after 1991.

I. INTRODUCTION

The purpose of this report is to identify the potential demand for and production of Colorado coal from 1986 to 1991, and to analyze the supply and demand factors and the coal market contingencies. It is designed to assist the Office of Technology Assessment with its mandate (P.L. 94-377) to make an independent evaluation of the development potential of existing federal coal leases in Colorado.

In order to determine the future market for Colorado coal it is first necessary to understand historical trends, the present market, and the coal characteristics. The uncertainties and changing patterns determining the future of Colorado production can be comprehended only with this perspective.

A. Historical Trends

It is misleading to generalize about Colorado coal or Colorado coal production. The State is unique in its diversity of coal deposits and markets. Colorado coal deposits include every rank of coal, are located in each geographic region of the State, include steam and metallurgical coal, range from 8,580 Btu's per pound to 15,200 Btu's per pound, are mined by almost every mining method, and are used by the residential, commercial, industrial, and utility sectors. However, there have been several significant historical trends.

In the 1800s Colorado experienced a steady increase in coal production, reaching one million tons per year (MTPY) in 1882. (See Table 1). This increase in production continued until 1907 when the State produced almost 11 MTPY. This corresponds to an annualized production increase of 3.6 percent over this period. The production during the years between 1908 and 1926 stabilized between eight MTPY and 12.6 MTPY. This latter figure, the production in 1918, was the highest level of production in Colorado until 1973. The State's production began to decrease in the late 1920s and dropped as low as 2.9 MTPY in 1958. This was due in part to the increased use of low-cost natural gas and the transition from coal-burning to diesel-powered locomotives. Only since 1971 has the State seen consistent and significant annual increases in coal production (See Figure 1). With this perspective, it is easier to understand why increases in coal production of over 20 percent a year (1977, 1978, 1979) have created generalizations about Colorado's coal industry that are not necessarily consistent with past or future trends.

As production increased in Colorado in the 1970s, the number of mines decreased. Historically, production came from many small operations (1-50,000 TPY). The substantial increases in coal production in the 1970s came primarily from the larger surface mines in Northwest Colorado producing around one MTPY. At the same time, small mines were forced to close due to new federal regulations, the retirement of older

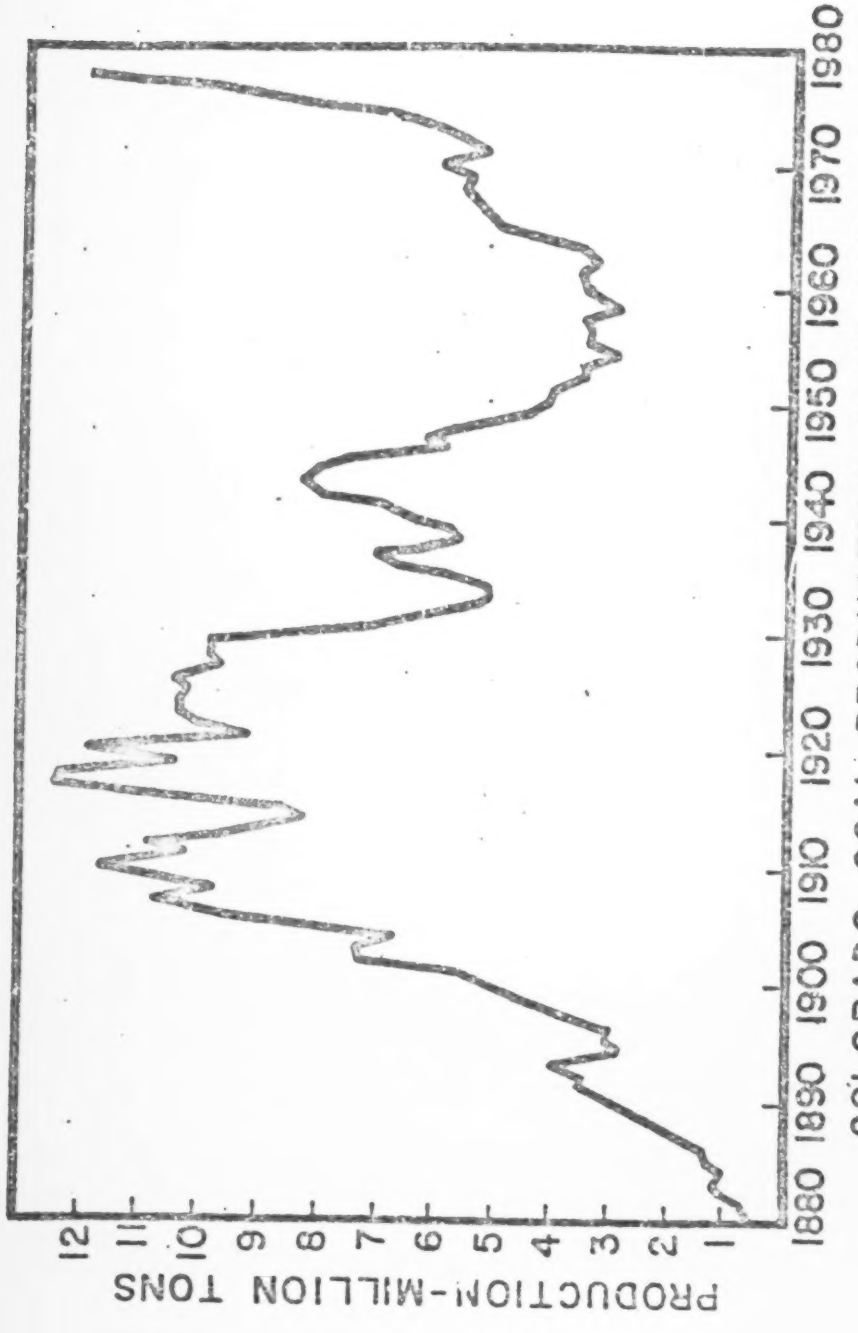
TABLE 1

COLORADO COAL PRODUCTION FROM 1864 THROUGH 1979

YEAR	TONNAGE	YEAR	TONNAGE	YEAR	TONNAGE
1864	500	1903	7,775,302	1942	8,131,764
1865	1,200	1904	6,775,551	1943	8,372,183
1866	6,400	1905	8,989,613	1944	8,202,401
1867	17,000	1906	10,308,421	1945	7,357,744
1868	10,500	1907	10,965,640	1946	5,941,105
1869	8,000	1908	9,773,007	1947	6,381,016
1870	4,500	1909	10,722,490	1948	5,682,561
1871	15,600	1910	12,104,887	1949	4,580,852
1872	68,540	1911	10,197,595	1950	4,273,887
1873	69,997	1912	11,016,948	1951	4,113,710
1874	87,372	1913	9,268,939	1952	3,643,549
1875	98,838	1914	8,201,423	1953	3,597,168
1876	117,666	1915	8,715,397	1954	2,922,377
1877	160,000	1916	10,822,185	1955	3,366,620
1878	200,630	1917	12,515,305	1956	3,304,268
1879	322,732	1918	12,658,065	1957	3,324,901
1880	462,747	1919	10,406,543	1958	2,972,573
1881	706,744	1920	12,514,693	1959	3,302,530
1882	1,061,479	1921	9,141,947	1960	3,624,572
1883	1,229,593	1922	10,003,610	1961	3,700,592
1884	1,130,024	1923	10,336,735	1962	3,393,245
1885	1,398,796	1924	10,501,088	1963	3,707,443
1886	1,436,214	1925	10,440,387	1964	4,401,025
1887	1,791,735	1926	10,616,760	1965	4,990,429
1888	2,185,477	1927	9,781,580	1966	5,227,705
1889	2,400,629	1928	9,921,585	1967	5,426,071
1890	3,075,781	1929	9,934,064	1968	5,579,044
1891	3,512,632	1930	8,238,094	1969	5,518,927
1892	3,771,234	1931	6,604,063	1970	6,021,062
1893	4,102,389	1932	6,616,525	1971	5,307,271
1894	3,021,028	1933	5,284,872	1972	5,530,179
1895	3,339,495	1934	5,251,003	1973	6,232,446
1896	3,371,633	1935	5,953,601	1974	6,950,686
1897	3,565,660	1936	6,868,801	1975	8,364,326
1898	4,174,037	1937	7,222,092	1976	9,461,513
1899	4,826,939	1938	5,730,291	1977	11,971,143
1900	5,495,734	1939	5,002,125	1978	14,359,399
1901	6,210,405	1940	6,673,359	1979	18,134,726
1902	7,522,923	1941	7,008,037		
			Accumulated Tonnage		650,529,544

Source: The above tonnages have been revised to date, according to USGS Report No. 6-1410 to 1883 and from the first annual reports of the Colorado Division of Mines.

FIGURE 1



Source: Colorado Coal Directory and Sourcebook, 1978

family operations, the depletion of the limited reserves that were profitable to mine, and a weak market. The result of these influences was a reduction in the number of mines from 68 in 1977, to 56 in 1979.

With this trend of small mine closings and increased production from large cost-effective surface mines, the average tonnage production of coal mines in Colorado has been increased. The surface mines in Northwest Colorado are producing one to three MTPY. There are now five, almost seven, mines producing over one MTPY (See Table 2). These five mines produced 9.2 MTPY in 1979 and accounted for 51 percent of the annual coal production in Colorado. Only one of these trends is likely to continue - that of small mine closings. At least four of the largest surface mines are nearing depletion of their reserves. With the loss of these mines, the trend will begin to reverse. Fourteen out of 24 mines proposed in Colorado anticipate production at less than one MTPY. In 1979, 31 mines were producing less than 100,000 TPY. Colorado has historically been a state of smaller coal producers. Future coal production depends in large part on the impacts of both future demand and governmental policies on the small mine operators.

Colorado, with between 75 and 94 percent of its coal reserves mineable only by underground methods, has historically been a producer of underground coal. There have always been more underground mines than surface mines in Colorado; however, production from surface mines did surpass production from underground mines in the mid-1970s. In the late 1970s, the trend toward surface production waned. It is predicted that production from underground mines will once again surpass that from surface mines between 1986 and 1991 (see Page v). While Colorado has numerous strippable coal reserves, many of these reserves have inappropriate characteristics for present markets, e.g., lignite rank. In addition, some significant marketable reserves will be depleted through current production by 1990. Seventeen out of 24 proposed mines are underground.

Metallurgical coal production has always been a substantial portion of Colorado coal production. At this time all metallurgical coal is mined by underground methods in Colorado. Metallurgical coal production has remained fairly stable, approximately three MTPY. As Colorado's annual production has increased, the percentage contribution of metallurgical coal production has been lessened (see Page v)

B. The Present Market

Colorado coal has historically been used for residential, commercial, industrial, and utility use. In 1979, 71.5 percent went to utility use, 26.6 percent to industry and commerical use, and 1.9 percent to residential use. Two years earlier, the breakdown was 80.9 percent to utility use, 18.0 percent to industry and commercial use, and 1.2 percent to residential use[1] (see Table 3). It should be noted that industry and commercial demand is a significant and perhaps growing factor in determining the present market.

---

[1]Colorado Energy Fact Book 1980/1981

TABLE 2

COLORADO MINES PRODUCING OVER 1 MTPY IN 1979

COLOWYO STRIP	1,699,438 tons
EDNA STRIP	1,165,902 tons
ENERGY STRIP #1	2,353,291 tons
SENECA STRIP	1,611.805 tons
TRAPPERS STRIP	2,328,732 tons
TOTAL	9,159,168 tons

Source: Colorado Division of Mines Production Report

TABLE 3

COLORADO COAL USE BY SECTOR IN 1977 AND 1979

1977

UTILITIES	80.8%
INDUSTRY, COMMERCIAL	18.0%
DOMESTIC, RESIDENTIAL	1.2%

1979

UTILITIES	71.5%
INDUSTRY, COMMERCIAL	26.6%
DOMESTIC, RESIDENTIAL	1.9%

Source: 1977 figures from Colorado Energy Research Institute Energy Fact Book 1980/81

1979 figures from data researched for this paper

N.B. methodologies varied, comparison can only be general

In 1975, 31 percent of Colorado's coal production was shipped out of the State. In 1976, Colorado's out-of-State coal shipments increased to 38.5 percent and 45 percent in 1979. Historically, Colorado has responded to in-State markets more than out-of-State markets. This trend is expected to continue. The recent increase in out-of-State shipments was due to the increase in surface mine production in Northwest Colorado. The markets creating this increase have dissipated. In addition, Colorado imports approximately 3.1 MTPY of Wyoming coal.

Existing contracts for Colorado coal are seldom the large long-term contracts Western coal operators hope for. As explained in the next section, Colorado coal has characteristics which make it a good blending coal. Hence, many contracts are in smaller quantities than if Colorado coal were the primary fuel source. Also for this reason, Colorado, up to now, has had much success with spot market contracts.

Presently, the highest percentage of Colorado coal goes to utility use. Colorado has three mine mouth electrical utilities. The oldest is the Nucla Power Plant and Nucla Mine, producing 100,000 to 150,000 TPY. The Hayden Plant and the Seneca Mine, producing 1.5 MTPY, is the second oldest. The newest is the Craig Power Plant and the Trappers Mine, producing 2.2 MTPY. All three utilities are owned by Colorado Ute Electric and all the mines are owned by Peabody Coal. Other utilities in the State burning Colorado coal are listed in Table 4. Figure 2 depicts the flow of Colorado coal to other states, while Table 5 lists the out-of-State utilities currently contracting Colorado coal.

Table 6 lists primary in-State and out-of-State non-utility users.

C. Coal Characteristics

The 434 to 454 billion tons of Colorado coal resources are ranked fourth in the U.S. and represent 11 percent of the nation's coal resources. Colorado is ranked seventh or eighth in the nation for its 14.9 to 16.3 billion tons of coal reserves. More significantly, Colorado ranks first in the nation for low-sulfur bituminous coal resources.

However, the market potential for Colorado coal is only loosely associated with the existing "resources" and "reserves" of the State. More important are the configurations of coal seams into logical mining units (LMU's), the surface and coal ownership, and the coal characteristics such as Btu value, rank, seam thickness, overburden depth, and sulfur, ash, and moisture content. As coal characteristics vary significantly between countries, states, regions, and even fields, it cannot merely be assumed that the cheapest coal will capture a given market. The market for Colorado coal is competitive and dependent upon the match of particular supply characteristics with particular demand characteristics at the right price. Colorado coals are noted for low contents of moisture, ash, and sulfur, as well as for generally high heating values.

Moisture content is generally in the one to 20 percent range. However, some of the subbituminous coals and lignite in the Denver

TABLE 4

COLORADO UTILITIES BURNING COLORADO COAL

UTILITY	PLANT
Central Telephone and Utilities	Clark
	Rocky Ford (25MW)
Colorado Springs Department of Public Utilities	Martin Drake
	Nixon 1
Colorado Ute Electric Association	Bullock 1,2
	Craig 1,2
	Hayden 1,2
	Nucla 1,2,3
Public Service Company of Colorado	*Alamosa (25 MW)
	Arapahoe 1,2,3,4
	Cameo 1,2
	*Valmont 1,2,3,4,5,6
Trinidad Electric Power and Light Department	Trinidad (25MW)
Walsenburg Utilities	Walsen (25MW)
Western Colorado Power	Jim Bullock

*Also burning Wyoming coal

TABLE 5

OUT-OF-STATE UTILITIES CONTRACTING COLORADO COAL

Arizona Electric Power	Arizona
American Electric Power	Illinois
Central Illinois Light Company	Illinois
Central Illinois Public Service Company	Illinois
Northern Indiana Public Service Company	Indiana
Ames Electric Utility	Iowa
Cedar Falls Municipal Utilities	Iowa
Corn Belt Power Co-op	Iowa
Iowa Electric Light and Power	Iowa
Mississippi Power Company	Mississippi
Fremont Department of Utilities	Nebraska
Raton Municipal Power	New Mexico
Ohio Electric	Ohio
Southwest Public Service Company	Texas
Texas Central Power and Light	Texas

FIGURE 2

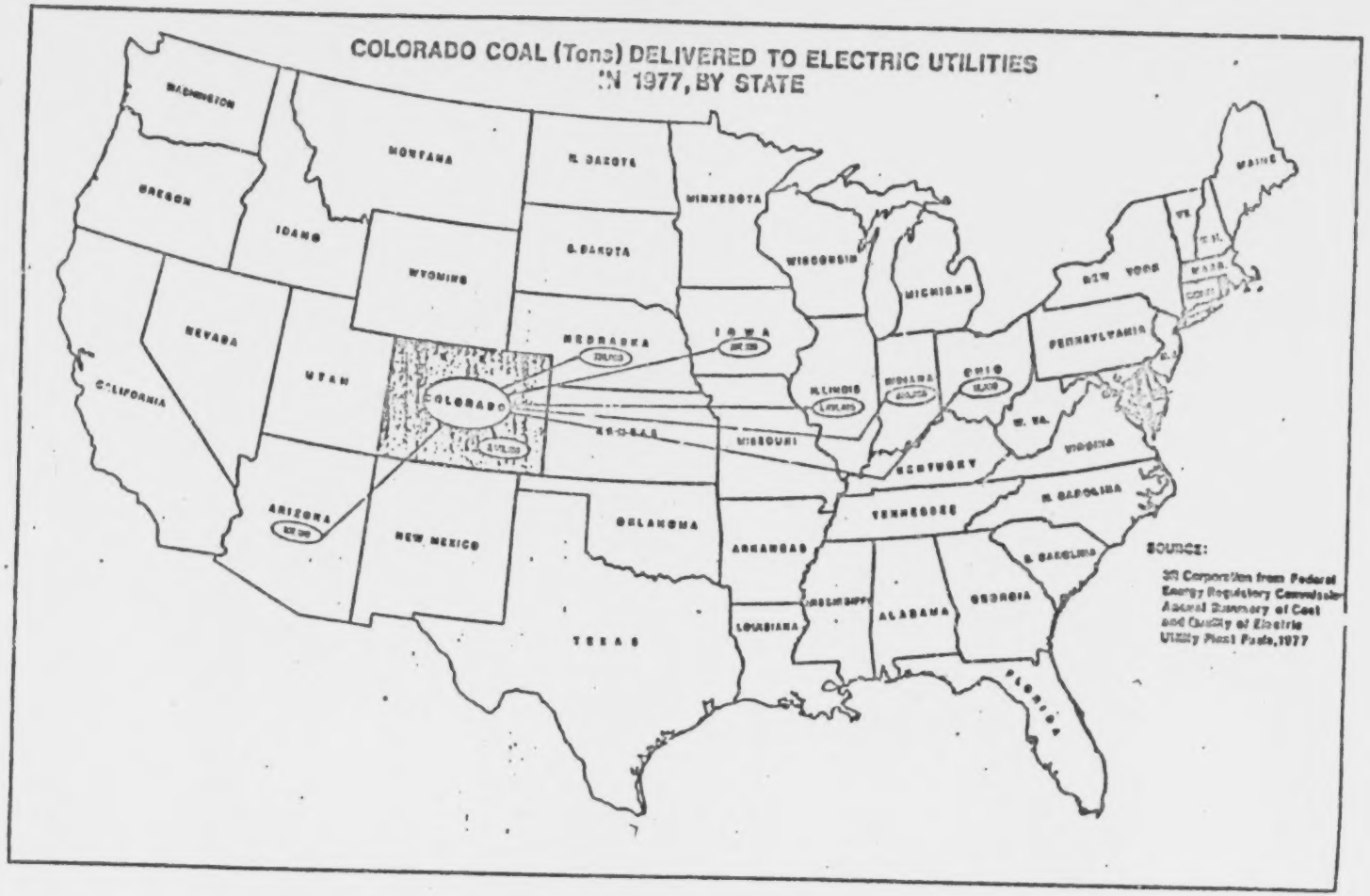

COLORADO COAL (Tons) DELIVERED TO ELECTRIC UTILITIES
IN 1977, BY STATE
WASHINGTON
OREGON
CALIFORNIA
IDAHO
NEVADA
MONTANA
WYOMING
UTAH
ARIZONA
COLORADO
NEW MEXICO
N. DAKOTA
S. DAKOTA
NEBRASKA
KANSAS
OKLAHOMA
TEXAS
MINNESOTA
IOWA
MISSOURI
ARKANSAS
LOUISIANA
WISCONSIN
ILLINOIS
MICHIGAN
INDIANA
OHIO
KENTUCKY
TENNESSEE
MISSISSIPPI
ALABAMA
GEORGIA
FLORIDA
S. CAROLINA
N. CAROLINA
VIRGINIA
W. VA.
PENNSYLVANIA
NEW YORK
MAINE
SOURCE:
Tabulation from Federal Energy Regulatory Commission Annual Summary of Cost and Quality of Electric Utility Plant Data, 1977

TABLE 6

NON-UTILITY CONSUMERS OF COLORADO COAL

Out-of-State

American Smelting
Ashgrove Cement
Catepillar
Celanese Chemical
Celetex
CRA Inc.
G.W. Sugar
Kaiser Steel
Kennecott Copper
Rio Algon Corporation
Silco
U.S. Steel

In-State

AMAX
CF&I Steel
Colorado School for the Deaf
Colorado Penitentiary
Colorado State Hospital
Cumbres-Toltec Railroad
Durango-Silverton Railroad
G.W. Sugar
Holly Sugar
Ideal Cement
Pueblo Army Depot
West End School District

region contain as much as 38 percent moisture. An average for Colorado coals is 12 percent moisture. The ash content of Colorado coals typically ranges from two to 20 percent, averaging approximately six percent. In some cases, however, ash content may reach 25 to 30 percent. Sulfur content of most Colorado coal beds varies from 0.2 to 1.2 percent. More than 99 percent of the coals contain less than 1.0 percent. For utility use, this translates roughly into 0.2 to 0.5 pounds of sulfur per million Btu.

Most of the bituminous and subbituminous steam coal produced in Colorado ranges from approximately 10,000 to 13,600 Btu/lb. On a dry, ash-free basis, most coals vary between 13,300 and 14,500 Btu/lb. Coking coal ranges from 12,070 to over 14,000 Btu/lb.

Most Colorado coal occurs in four to 15 foot thick, closely spaced, multiple beds with an overburden of 100 to 500 feet. The beds dip steeply in places and are usually highly lenticular, variable in thickness, and overlain by roof rock of variable character. The thicknesses of the overburn change rapidly. With these configurations, the recovery rate of in-place reserves at an underground mine average 15 to 20 percent.

In addition, none of the Colorado coals sampled to date appear to contain significant quantities of toxic or radioactive elements (such as arsenic, mercury, selenium, strontium, thorium, and uranium.) In fact, most appear to have smaller amounts of these substances than do coals from other regions in the U.S.

Most of these coal characteristics seem to indicate a strong market for Colorado coal. The lack of moisture content leads to higher calorific content and easier transportation. The low ash content means very few Colorado coals need to be washed, an added cost. The low sulfur content makes the combustion process more efficient with less SO_2 emissions. The high Btu values bring more energy from less coal and reduce transportation costs. The lack of toxic substances reduces the problem of potentially hazardous wastes. These properties, however, must be balanced with governmental policies, mining costs, transportation costs, and lead time requirements to determine the strength of future markets for Colorado coal.

II. MAJOR MARKET DETERMINANTS AND PRODUCTION CONTINGENCIES

The present market for Colorado coal is easy to identify through the examination of existing contracts and present production. The future market for Colorado coal in the short term is also fairly easy to assess. Utilities and mines under construction have contracts for coal supplies. Although contracts may be broken, they are still good indicators of the short-term supply and demand. Based on current experience, it takes from six to eight years lead time from initiation to mine production, with an additional one to two years to reach full production. Future markets up to 1988, therefore, are fairly predictable.

However, it is very difficult to forecast markets for Colorado coal, beyond eight years. It is of no value to extrapolate from the present. New policies and legislation, new technologies, and new foreign situations will make substantial changes in present trends.

The following market determinants and contingencies will be analyzed as they affect the present, near future, and possibly far future markets for Colorado coal.

A. Federal Policies

While many factors affect the market for Colorado coal, the most significant at this time, as well as the most uncertain, are the impacts of federal policies. Those with the greatest impacts include federal policies governing:

- air standards
- coal transportation
- coal management/leasing
- synthetic fuels
- coal conversion
- nuclear power
- foreign trade
- reclamation
- energy mobilization board

1. Air Standards

The Clean Air Act of 1970, among other things, set standards for SO_2 emissions. The regulations of 1971 made it economically advantageous for Eastern and Midwestern consumers to ship low-sulfur Western coal long distances. The alternative was to install expensive and often unreliable scrubber devices on their facilities to reduce the SO_2 emissions. Colorado, especially, benefited from this federal policy, as evidenced in the increased rate of coal production in the 1970s. Much of today's production is based on contracts resulting from this legislation.

However, in 1977, the federal Clean Air Act Amendments reversed this advantage. The 1979 promulgation of revised New Source Performance

Standards reduced SO_2 emissions by requiring the use of the best available control technology, and hence eliminated the advantage obtained by shipping low-sulfur Western coal long distances to Eastern and Midwestern markets. These regulations favor production of coals closest to the user, regardless of sulfur content.

The Colorado coal producers are already feeling the impact. Spot market sales are harder to come by. Several options with Midwestern utilities have been cancelled. Present negotiations have been limited mainly to Western utilities, where the closest local coal has distinct advantages. Mines started in anticipation of Midwest utility contracts are not producing at capacity. In one instance, at least four Colorado mines, all operating under capacity, are hoping for a contract with a proposed Western Slope utility plant scheduled to open in 1987.

These newer air quality regulations pertain to utilities and large industrial boilers beginning operation between 1985 and 1993. They will, therefore, continue to affect Colorado coal markets in the near future. How they will affect the market past 1990 is very uncertain. It is possible that these regulations will be revised again. New energy development in the West, acid rain problems, and shifting power in Congress will surely amend federal air policy again.

In addition to the SO_2 and New Source Performance Standards, the federal government is promulgating regulations on the prevention of significant deterioration (PSD) according to the Clean Air Act Amendments of 1977. While rules have been issued regarding most pollutants, the visibility issue has been studied and restudied because of the difficulty in determining the appropriate standard and measurement for this characteristic. Proposed regulations were released in the summer of 1980 and the initial reaction has indicated the need for major revisions. While PSD requirements have not been a constraint in Colorado (56 permits have been issued, only one denied, since 1976), the visibility requirements may be. According to the proposed regulations, power plant sitings in Colorado may be extremely difficult due to their proximity to Rocky Mountain National Park, Sand Dunes National Monument, and existing wilderness areas. While PSD and visibility regulations have had no impact on the market for Colorado coal, and will have little impact for the next six to eight years, they may have a severe impact in the distant future. If new utilities may not locate within Colorado boundaries, then Wyoming, Utah and New Mexico coals will be more competitive serving utilities in their own states.

2. Coal Transportation

The cost differences between Eastern, Midwestern, and Western coal for any market is primarily dependent upon the price of shipping. Transportation costs become the substantial portion of the delivered costs of coal outside of local market areas. Recent contract negotiations have resulted in transportation costs comprising 50 to 75 percent of the delivered price of coal.

The primary mode of Western coal transportation is train or unit train. Several coal slurry lines have been proposed. Both of these

modes are significantly affected by federal policy. Railroad rates are approved by the Interstate Commerce Commission (ICC), which currently allows the railroads to increase coal rates to cover general declining incomes and new capital investments for all track, equipment and maintenance. In addition, the ICC prohibits long-term contracts between railroads and utilities. This allows for renegotiation, higher rates, and more uncertainty.

The U.S. Congress has also been sympathetic to the financial plight of railroads and has passed H.B. 7235 and S.B. 1946 to deregulate the railroads. The conference committee will have to iron out major differences, so the final bill is not known at this time. However, it will certainly affect the price of and markets for Colorado coal.

Coal slurry pipelines would offer competition to the railroads for transporting coal. Again, federal policy is playing a major role. The major constraint to slurry pipelines is the lack of eminent domain, especially over railroad lands. Legislation has been introduced in Congress every year, for at least seven years, to grant slurry pipelines the power of eminent domain. While a slurry pipeline could probably secure this power through numerous court cases, such legislation would make it much easier and less costly to build slurry pipelines. While these bills have passed committee, they have never passed a House vote. This session, H.B. 4370 cleared the Public Works and Interior Committees. S.B. 2665 has not yet cleared the Energy Committee or even had a hearing in the Commerce Committee. Passage, therefore, is doubtful.

Federal coal transportation policies have definitely affected present and future Colorado coal markets. Undoubtedly, they will continue to affect Colorado coal markets. The Denver and Rio Grande Western Railroad owns virtually all the track used to transport Western Slope coal to the Eastern Slope. There is no competition. In addition, coal moving from the Western Slope to Eastern Slope, Midwestern, Eastern, or Southeastern markets must pass over Tennessee Pass or through Moffat Tunnel. Both of these geographic obstacles increase shipping costs by reducing the number of cars a train can haul, increasing the number of engines required, increasing the need for numerous switching movements, requiring more train crews, and preventing the expansion of track capacity.

Because of these transportation costs, it has been more economical for Eastern Slope Colorado utilities to contract for Eastern Slope Wyoming coal. Hence, the Arapahoe Plant, the Cherokee Plant, the Comanche Plant, the Valmont Plant, and the under-construction Pawnee Plant and Rawhide Plant all have contracts with Wyoming, rather than Colorado mines. If Colorado coal cannot compete for utility markets within Colorado, it will be extremely difficult to compete for contracts with utilities in other Western states. This transportation cost constraint also applies when competing for contracts with Midwestern, Eastern, or Southeastern utilities. At present, in all these cases, Colorado coal is at an additional disadvantage due to West-East track configurations over the Rocky Mountains. In the long-term, however, if new markets develop to the Far West (California and Asia), then Colorado would have the advantage of not having to cross the Rocky Mountains.

Coal slurry pipelines will probably not affect Colorado coal markets in the near term. The proposed San Marco slurry line from Walsenburg, Colorado to Southeast Texas would not remove the railroad transportation costs between Northwest or West Central Colorado and Walsenburg. However, in the longer term, several proposed mines in Southeast Colorado would benefit from this pipeline.

Also, in the longer term, W.R. Grace Company has proposed a methanol or CO_2 coal slurry pipeline to the West Coast, probably California (see Page 19). Depending on the economies of their proposed synfuel plant and the market for its products, this synfuel slurry could substantially reduce transportation costs to markets West of Colorado.

3. Coal Management/Leasing

In Colorado, 36 percent of the land is managed by the federal government, 4 percent by the State, 1 percent by Indians, and the remaining 59 percent is in private ownership. The majority of coal production has been on private or State lands. Seventy-five percent of Colorado's coal resources are either on private or State-owned lands. The percentage of federal ownership, however, varies in the different coal regions; the highest percentage most likely in Northwest Colorado where there is currently the greatest coal production. While Colorado has maintained a coal industry primarily on State and private land, it is becoming more dependent upon federal coal to complete logical mining units (LMU's). As with most western states, Colorado's checkerboard ownership patterns often mean multiple jurisdictions are involved. The coal industry, hence, must work with the federal coal management program.

Prior to 1971 there was a significant increase in federal coal leasing with a very insignificant increase in federal coal production. This discrepancy between the amount of coal leased and the amount produced was a primary reason the Department of the Interior (DOI) declared a moratorium on federal coal leasing in 1971. Another reason was the growing belief that there should be a coal leasing system which recognized more factors and criteria than the presence of coal under federal land. Two changes in administrations, three significant laws, and a major court case delayed the release of a new federal coal management program until June of 1979.

The federal coal management program is based on land use planning. Activity planning and regional production goals then determine the need for lease sales and leasing targets. Tract selection is the final major process before the sale. The program also incorporates DOI policies on lands unsuitable for mining, due diligence, continuous operation, fair market value, and emergency leasing.

The uncertainty during the 1970's of what the federal coal management program would be and the uncertainty of how it will actually work has affected western coal markets. The first competitive lease sale under the federal program is scheduled for January 1981 for tracts in the Green River - Hams Fork Coal Region (Colorado and Wyoming). There are still many problems to work out to refine the program from theory to

practice. Since Colorado coal is included in the first lease sale, the State is not at the disadvantage of the other states where there will be no lease sales until 1983, 1984 or 1985. On the other hand, because of the rush to hold the 1981 sale, there are a limited number of tracts available for lease.

Colorado coal production has probably not been seriously affected by the lack of regular federal leasing during the 1970's.[2] The number of non-producing federal leases and the mines operating under capacity is evidence of such. The federal lease sales in 1981 will be important to several operators in Northwest Colorado to continue their current rates of production on adjacent federal lands. Except in these instances, federal lease sales will not be crucial in the short-term future. While the lack of a sale may impact a certain company or mine, it should not impact the market potential for Colorado coal. In the longer term, federal lease sales may be crucial for new markets such as synthetic fuel developments and Asian markets. The lead time requirement for the former, however, should be as lengthy as the lead time requirement to obtain a lease.

Other aspects of the federal coal management program will probably have greater impacts on Colorado coal production and markets than the lease schedule; namely fair market value, royalties, due diligence, continuous operation, and preference right lease applications.

DOI is still studying approaches to determine what the fair market value of federal coal will be at the time of a lease sale. The decided process and resulting value will not only affect the lease price but also have an impact on prices of coal from comparable mines. By setting fair market values for different coal regions in the West, DOI could conceivably set up artificial regional advantages or disadvantages. This would affect the long-term future markets for Colorado coal one way or the other. There is no way to determine whether the impact may be favorable or unfavorable.

Royalty payments on federal coal have increased significantly over the last decade. The Federal Coal Leasing Amendments Act set them at 12.5 percent. This rate has had two immediate impacts. First, the Colorado State Board of Land Commissioners has raised the state royalty rate to match the federal rate. Second, federal leases existing prior to 1975 have enjoyed much lower rates (i.e. three to four percent). This has created an artificial and significant advantage to some operators, a disadvantage to newer operators. As the 20 year lease period ends, however, these older existing leases are renegotiated at the higher 12.5 percent rate. One mine in Colorado lost two significant contracts when its royalty rates changed significantly. The result is major shifts in markets and layoffs in certain mines because of the lack of transition between the old and new royalty rates. At least three additional mines in Colorado will face this large royalty rate increase by 1990. This will negatively affect both short and long-term future Colorado coal markets.

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[2] Some mines have been significantly affected by the delays and uncertainties in aquiring bypass, emergency, or short term federal leases.

The Federal Coal Leasing Amendments Act also changed DOI's due diligence and continuous operation regulations. The intent of these regulations is to encourage production from existing and newly issued coal leases and to limit long range speculation. The regulations determine when the first production must take place on a lease and how much coal must be produced annually throughout the life of a lease. Although these regulations are supposed to allow coal operators time to establish markets, form their capital, and develop their mines, the ten year due diligence period can be imposing with soft coal markets. Extensions are only possible for leases issued prior to August 4, 1976.

The impact of these regulations on Colorado coal production presently is that several mines are producing and stockpiling coal without markets, rather than losing their lease. Since June 1, 1985, is the first due diligence deadline, the current extra production will most likely be only the beginning of major stockpiling in the State. This may lower the price of Colorado (and Western) coal, significantly affecting future coal markets.

As of January 1980, there were 37 federal Preference Right Lease Applications (PRLAs) pending in Colorado. By law these must be processed by December 7, 1984. According to a DOI Solicitor's opinion, they must all be adjudicated prior to issuance. In addition, there is limited funding authorized by OMB for PRLA processing. This is creating delays and more uncertainty. The outstanding PRLAs involve 82,910 acres in Colorado. Even if many of the PRLAs never go into production, a significant amount of coal reserves are in a hold pattern. While present coal production is not affected by PRLAs, future production may be. If just one-fourth of the PRLAs are issued in 1984, there could be additional over capacity in Colorado. Some of the PRLAs were applied for because of speculation for synfuel development. Once processed, these larger tracts could provide the quantities of coal necessary for coal synfuel markets. But as long as there is a soft market for Colorado coal and over capacity, PRLAs should not make a significant difference in the future.

4. Synthetic Fuels

The rate and timing of synfuel development from coal is one of the greatest areas of uncertainty in assessing future coal markets. This determinant will also have one of the most significant impacts on Colorado coal production. And once again, the federal government is the significant player. While some companies are planning coal synfuels projects without government support, the federal government is nonetheless involved through price supports, subsidies, research and development, and marketing. The federal Energy Security Act, with production goals of two million barrels per day equivalent and $88 billion investment for loans, purchase agreements, price guarantees, and loan guarantees, will undoubtedly encourage synfuel development at a faster rate than the current market would allow. In addition, the Department of Energy (DOE) has been authorized to spend $600 million for feasibility studies and cooperative agreements and $5 billion for financial assistance to encourage synfuel development.

Colorado has no existing coal synfuel projects. In 1977, Cameron Engineers proposed a 15 MTPY synfuel plant near Watkins, Colorado. This project never materialized, but rumors have recently started that this plan is being reconsidered. The only officially announced proposed synfuel project is that of W.R. Grace Company for Northwest Colorado (Axial Basin). The proposed coal-to-methanol project, using the technology of Koppers Company, Inc., would produce 5,000 tons of fuel grade methanol (17,000 barrels) from 5,000 to 8,000 tons of coal a day. The company also plans to ship 3.5 MTPY of coal out of the state. Under this proposal, one synfuel plant would increase Colorado coal production by at least five MTPY, or 20 percent of this year's production. W.R. Grace has been awarded an $800,000 grant from the Department of Energy to do feasibility studies on this project.

In spite of all the technological, financial, and licensing uncertainties surrounding synfuel development, industry is encouraged by the strong federal policies to develop synfuels as rapidly as possible. Companies are trying to find or amass larger blocks of coal reserves. There are probably several additional coal synfuel projects being considered beyond those publicly announced. Because there is much proprietary information, unproven technologies, an unidentified market, changing federal policy, and the uncertainty of how the Energy Security Corporation will actually function, it is next to impossible to predict how synfuel development will affect long-term future Colorado coal production. And yet, if it does affect production it will do so signicantly. Because of the significant lead time required to have a commercial facility on line, there will probably be no synfuel impact on Colorado coal production by 1991.

5. Coal Conversion

The coal industry, the government, and the World Coal Study all say that the U.S. and other countries should shift from oil to coal as the fuel for the generation of electricity. The supplies are more abundant and the price is lower. However, without strong incentives this coal conversion has not taken place. The cost of retrofitting boilers is prohibitive, often exceeding the cost of building a new boiler. The Federal Power Plant and Industrial Fuel Use Act, designed to encourage conversion to coal, lost its strength when it became law. The Natural Gas Policy Act, passed at the same time, encouraged additional natural gas production due to price deregulation. Some utilities were told to stay with natural gas to reduce air emissions, rather than switch to coal. With these high capital costs and political uncertainties, utilities and industries are not converting.

Coal conversion uncertainties could affect the market for Colorado coal. While most Colorado gas-fueled industries and utilities converted to coal in the early 1970's, there are many oil and gas-fueled boilers in Oklahoma, Texas, and the South Central states. If these industries and utilities decided to burn coal, a likely market would be Colorado coal. There would, however, be some constraints on this new market. First, the South Central states have shown a preference for burning local lignite, rather than paying the high transportation costs of Western coal. Second, South Central utilities are negotiating contracts

with foreign coal producers, again to avoid paying the high transportation costs of Western coal. San Antonio utilities are already using foreign coal. Third, because of rail networks and the Rocky Mountains, Montana and Wyoming coal are presently more competitive for most South Central markets. Lastly, as the San Juan basin in New Mexico is further developed, this coal will also be more competitive.

In summary, current coal conversion policy is not affecting present Colorado coal markets. While there is some feeling that stronger policy would increase demand for Colorado coal, the present situation appears to argue that it would not. Therefore, present and short-term future markets for Colorado coal will probably not be affected by coal conversion policy. However, one cannot predict what effect a very strong coal conversion policy might have in the long-term if several variables or market determinants, such as transportation, shifted.

6. Nuclear Power

The future of nuclear powered utilities is very uncertain and depends upon federal policy. After Three Mile Island (TMI), many speculated about a moratorium on the construction of nuclear facilities. In actuality, all nuclear plants licensed or under construction are being completed. One new plant has been licensed since TMI. While the negative impacts of TMI have not been as severe as anticipated, there is still reservation about going ahead with new nuclear plants. The Congressional requirement that waste disposal plans and evacuation plans be completed prior to licensing could cause potential problems.

Probably more important than licensing policy are the frequent shut downs because of technological problems and the inability of plants to run at or maintain designed production levels. These, combined with cost overruns and negative public opinion, have made nuclear power plants high financial risks. At this point, the future for nuclear power seems limited. Severe problems with OPEC or strong federal pressure could revive this interim alternative source of energy.

Because of the decreased U.S. and Western U.S. rate of electrical demand, the present market for Colorado coal has not been affected by nuclear uncertainties. The future market for Colorado coal however, depends in part on the future of nuclear power. Many of the existing and proposed nuclear plants are located in the Midwest, a potential market area for Colorado coal. While some of these proposed plants have been cancelled due to low electrical growth, others will be cancelled due to regulations or financing. These may be replaced by coal-fueled units.

7. Foreign Trade

Federal foreign trade policies are becoming more important determinants of coal markets. At this time the most viable new or expanding market for Colorado coal is foreign exports - Japan, Taiwan, and Korea. (It is assumed that the demand from Germany, France, and Western Europe will be met by Eastern mines.) Currently Asian countries

are buying Colorado coal for test burns. They specifically demand high Btu bitumunous coal with low ash, moisture, and sulfur content. Several groups, including the Western Regional Council and the Western Governors' Policy Office, are heavily promoting Western coal to these markets. At this time Utah coal appears to have some competitive edge, and Colorado coal appears to be too expensive. However, because of Japan's strong policy to avoid dependency on one source of fuel (Austrialian coal), because of the balance of payments problems with the U.S., and because of the pressures from the auto industry to reduce Japanese car imports, these pricing problems could be outweighed by politics.

The current market for Colorado coal is being affected by foreign market prospects. Colorado coal producers are optimistic for a strong market. Coal is being purchased for test burns. W.R. Grace's coal-to-methanol project would probably not include a slurry pipeline and 3.5 MTPY out-of-State shipments if it were not for Asian market prospects. As far as one can predict foreign policies, it is expected that foreign coal markets will have one of the most significant impacts on future Colorado coal production. At this time, however, there are no signed contracts with this market.

8. Reclamation

When considering federal coal policies, the Surface Mining Control and Reclamation Act of 1977 (SMCRA) comes to mind. The regulations for SMCRA are still being promulgated, contested, litigated, and rewritten. Coal mine operators are still unclear as to what the final regulations will be. To confuse the matter further, the U.S. Senate passed a bill this year allowing state-administered programs to follow the intent of SMCRA without following the federal regulations. Until the SMCRA regulations are permanent and litigated and the state programs approved, mine operators will remain hesitant to submit mine plans.

In spite of all this uncertainty SMCRA has little impact on Colorado coal markets or production. SMCRA regulations may eliminate certain existing tracts from going into production due to surface owner consent or lands unsuitable for mining, but it is not expected to be a constraint on marketing Colorado coal. Reclamation costs will raise the price of coal, but will do so in all coal regions. These extra cents per ton may alter competition between several mines but should not alter the demand for Colorado coal. Wyoming and Montana reclamation costs may be higher per acre, but there are thicker seams, hence more coal, under each acre. Eastern coal in general will have higher reclamation costs. This may create a slight market advantage for Western, or Colorado, coal. Lastly, the majority of future Colorado coal production will be from underground mines. Therefore, SMCRA has little impact on Colorado coal markets at present, and will have less impact in the future. The most significant impact may be on the small mining operators who cannot afford the staff or consultants to prove compliance.

9. Energy Mobilization Board

While Energy Mobilization Board (EMB) legislation did not pass this Congressional session, there is significant support for the general

concept of easing federal regulatory red tape, delays, and uncertainties. As mentioned in the last section, uncertainties over SMCRA regulations have caused much confusion and delays of the submission of some mine plans. It was also pointed out that the confusion and delays do not significantly impact Colorado coal markets or production, except for the small mining operations.

The intent behind the EMB, however, was to assist large mining operations or coal-related facilities, such as coal-fired utilities or coal synfuel plants. These projects have the greater chance of permit denial, negative public response, and litigation. It is also these projects which require the larger amounts of coal. Hence, Federal EMB policy relates to the federal policy market factors previously mentioned - synthetic fuels, coal transportation, and coal conversion. Currently the EMB concept is not affecting Colorado coal markets. If an EMB law were passed, future Colorado coal markets would probably not be affected either. The production from an EMB project may begin a year or two earlier than anticipated, because of a shortened permit review process, but this would not be likely to affect the market.

B. State Policies

The states, especially the Western states, want to influence the timing, location, and scale of new coal development. This is largely because the state governments frequently pay the costs of the impacts. It is the responsibility of the state and local governments to pay for the highways, schools, water supplies, sewerage, solid waste disposal, health benefits, crime prevention, etc. With lack of coal development, permit denials or delays, the state and local governments pay the costs with the reduction of tax reserves and uncertain financing. While federal monies assist the states, federal decisions are often made without state input. Federal jurisdiction often preempts state jurisdiction, as over 60 percent of Western coal is under federal ownership.

State policies, therefore, have limited influence on coal production. Similarly, except when several states form coalitions, they have limited influence on interstate commerce and coal markets. The states have had influence, however, in the following areas:

- severance taxes
- water policy and water law
- state land management
- regional coal teams
- admir stration of federal regulatory programs

1. Severance Taxes

In part to pay for some of the costs mentioned above, the Western states have imposed severance taxes, a type of excise tax, for severing coal resources from the ground. This tax is often in addition to general property taxes on minerals. The rationale for such taxation may be to compensate for the irretrievable loss of a resource, to provide a trust for when the economic base of a mineral is depleted, to pay eco-

nomic rent, to export the tax burden out-of-state, to reduce development, to encourage one mineral use over another, or to internalize the social and public costs of mineral development.

Although state imposed severance taxes are not new, there is a current movement questioning the right of a state to impose an "unreasonable" tax rate which results in significant out-of-state tax burdens. Two states, Montana and Wyoming, have severance taxes on coal exceeding 12.5 percent.[1] North Dakota is considering such action. Legislation has been introduced in Congress limiting state severance taxes to 12.5 percent.

Currently, there is significant discrepancy between the severance tax on coal in the Western states (see Table 7). While Montana imposes a tax of 30 percent of value, Utah has no tax at all. Colorado has a conservative severance tax, passed in 1977.

It is widely debated whether severance tax levies affect coal markets. It is known that the high rate of Montana's severance tax has reduced Montana's coal production. Several operators purposely moved from Montana to Wyoming. But Wyoming's severance tax is also high. It is unknown whether the shift in production location affected any markets in the East. While some operators complained in 1976 that a Colorado severance tax would undermine the market for Colorado coal, the addition of the tax probably did not have any impact on the markets or Colorado's coal production. For surface mines, the 63 cents a ton is not as influential as the $20/ton shipping cost, and is balanced out by factors such as non-union labor, productivity, and low ash coal. In addition, Colorado's severance tax is more lenient for underground coal production.

The present market for western coals, therefore, is probably affected in a small way by the differences in severance taxes between the states. It is not the severance tax, but the significant differences between two states' taxes with similar coal types that affects the market. Because most Colorado coal has characteristics so different than Montana or Wyoming coal, the severance tax policy of states currently has little impact on Colorado coal markets. It is unlikely that Colorado's severance tax rate will increase significantly. Hence, it is unlikely that Colorado's future coal markets will be impacted by Colorado's severance tax policy.

2. Water Policy and Water Law

The availability of water affects coal-fired utilities, coal synfuel plants, and coal slurry pipeline transportation, but not coal mines. However, as explained earlier, these three developments are significant determinants of Colorado coal markets and production. The water laws in each Western state affect these developments in different ways.

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[1] Wyoming's severance tax is actually 10.5 percent. But Wyoming also has franchise, property, and impact taxes which total 17 percent.

TABLE 7

COMPARISON OF SEVERANCE TAXES ON SURFACE-MINED COAL

	8,000 BTU/lb. $6.50/ton*	8,500 BTU/lb. $8.00/ton*	10,500 BTU/lb. $16.50/ton*	11,500 BTU/lb. $19.50/ton*
Colorado ($0.63/ton)				
dollars/ton	0.63	0.63	0.63	0.63
dollars/million BTU	0.04	0.04	0.03	0.03
percent of value	9.7%(4)**	7.9%(4)**	3.8%(5)**	3.2%(5)**
Montana (30% of value)				
dollars/ton	1.95	2.40	4.95	5.85
dollars/million BTU	0.12	0.14	0.24	0.25
percent of value	30%(1)	30%(1)	30%(1)	30%(1)
New Mexico (43.5¢/ton plus 0.75% of value)				
dollars/ton	0.48	0.50	0.56	0.58
dollars/million BTU	0.03	0.03	0.03	0.03
percent of value	7.4%(5)	6.2%(5)	3.4%(6)	3.0%(6)
North Dakota (63¢/ton)				
dollars/ton	0.83	0.83	0.83	0.83
dollars/million BTU	0.05	0.05	0.04	0.04
percent of value	12.8%(2)	10.4%(3)	5.0%(3)	4.3%(4)
South Dakota (4.5% of value)				
dollars/ton	0.29	0.36	0.74	0.88
dollars/million BTU	0.02	0.02	0.04	0.04
percent of value	4.5%(6)	4.5%(6)	4.5%(4)	4.5%(3)
Utah (none)	--	--	--	--
Wyoming (10.5% of value)				
dollars/ton	0.68	0.84	1.73	2.05
dollars/million BTU	0.04	0.05	0.08	0.09
percent of value	10.5%(3)	10.5%(2)	10.5%(2)	10.5%(2)

* F.O.B. Mine

** Number in parentheses represents rank among the six states for each class of coal.

Source: Colorado Energy Research Institute, Mineral Severance Taxes in the Western States: A Comparison, 1979

In Colorado, the state legislature has passed several bills, and is constantly introducing bills to redefine or clarify water rights and water usage. Water rights have not yet become a problem or constraint on any energy facility. However, a study completed in July 1980 by the Colorado Energy Research Institute, Water and Colorado's Future, concludes that while there will be no shortfall of water in any state hydrologic region by the year 2000, even with extreme increases in energy development, there will be impacts which must be addressed. For example, new water storage reservoirs must be built, costs will rise rapidly, and groundwater supplies may have to be depleted to make up for surface water shortages. State policies (and federal policies) on new reservoirs and the costs of water could, therefore, have a significant impact on future Colorado coal markets.

At present, the greatest water disputes concern several Western proposals for Western coal slurry pipelines using water as the liquid medium. The rational for the high degree of political sensitivity is that the water for slurry use would be shipped out of the state or a river basin. In response, the Colorado state legislature passed a law in 1978 prohibiting the shipment of water with coal to a different state without credit for Colorado's portion of an interstate compact. In addition, the state legislature funded extensive studies of groundwater supplies and rights to determine the legal authority of water usage for the proposed San Marco pipeline. The Western states have also succeeded in putting riders on the federal coal slurry eminent domain bills to reaffirm state authority over water rights.

The executive branch of Colorado government has been less vocal, but recognizes the sensitive political nature of water issues. Understanding that an average coal-fired power plant, using present commercial technology, consumes as much as ten times more water than an average coal slurry pipeline, the Governor has publically indicated a strong preference that coal, rather than electricity, be shipped out of the State.

None of these State policies pertaining to coal slurry have affected the current market for Colorado coal, although the latter has precipitated the building of a power plant burning Colorado coal in Utah, rather than Colorado. If the State prevents the construction of coal slurry pipelines using water, and if Southeastern users convert to bituminous coal, not lignite, then these policies might affect some future Colorado coal markets. If other Western states encourage coal slurries to be constructed, this would further reduce the demand for Colorado coal, as their coal would be shipped at much lower prices.

3. State Land Management

All the Western states have state-owned land, some with coal resources. While state land ownership is usually minimal when compared to private and federally owned lands, the states' policies on mining state lands can influence the location of coal production. State land is often checkerboarded with other lands within logical mining units. Lenient policy towards development can allow mining to begin on state lands prior to federal lease acquisition or EIS's. Strict policy toward development can prevent a mine from locating in a given area.

The Colorado State Board of Land Commissioners has changed policies in conjunction with federal policy changes. Leasing was allowed for speculation, halted in the early 1970s, reassessed, and a new policy developed in the late 1970s. While State coal lease sales are still set at the request of an operator, the environmental standards, the royalty rates, and the due diligence policies were strengthened. Nonetheless, Colorado's policy on mining State coal lands is to encourage responsible development. It should have no impact on present or future coal markets or production.

4. Regional Coal Teams

The Federal Coal Management Program stipulates that coal tract selection and ranking for lease sales shall be determined by a regional coal team. This team is comprised of three representives for each state containing the coal bearing region. One of the three members represents the governor of the state. With voting privileges, this member may impose state policy on federal lease sales. While this influence has yet to be tested, it could have significant impacts on future sales and on a state's production. This potential influence has no impact on present coal markets, but if used to support an extreme policy (i.e., no synfuel plants within the state) it could influence future coal markets, including those for Colorado coal.

5. Administration of Federal Programs

Much federal environmental legislation allows for the administration of a federal program by the state. While the standards and guidelines are set by the federal government, there is often some flexibility within the state program. Colorado administers all federal air pollution regulations (save PSD), all water quality standards, archeological and historical guidelines, solid waste regulations, and uranium mill tailings regulations. For three years the Colorado legislature has refused to authorize the State to administer the hazardous materials or waste regulations. It is assumed that Colorado will administer SMCRA once the final federal regulations are approved. Most Western states are in similar situations. Since no coal mine has ever been denied the necessary permits, and since neighboring states have similar regulations, these state/federal regulatory programs have no impact on Colorado coal markets. Unless severe environmental carrying capacity problems develop (non-attainment areas) or unless mining wastes are analyzed as extremely hazardous (possible with coal synfuels), these regulatory programs will have no impact on future Colorado coal markets. Even if the states are allowed to develop individualized reclamation programs without following the federal regulations, it is doubtful that the differences in programs would affect the coal markets.

C. Lead Time Requirements

At present the lead time to open a coal mine in Colorado is between six and eight years, with another one to two years to be in full production. Several primary factors influence this lead time: equipment availability, permit approvals, regulation uncertainties, federal lease sales, consumer negotiations, construction delays, miner and supervisor

availability, transportation contracts, financing, industry's management skills, and coal market consistency. Because of the variety of factors, it is doubtful that lead times could be reduced by much more than a couple years.

At present, in Colorado, and especially in Montana and Wyoming, several mines are not operating at their capacity - capacity meaning what a mine would produce, without additional capital investment, if there were a market. With a soft market, lead time requirements are not as important. However, if there were no extra capacity, lead time requirements could become very significant constraints on future coal markets. This especially pertains to market shifts due to policy changes or critical situations, such as oil embargoes or strikes. It would not pertain to coal markets for projects also requiring significant lead times, such as synfuel plants or coal-fired utilities.

D. Coal-Related Technologies.

Changes in technology could influence Colorado coal production and coal markets. Not only is technological development crucial to the coal synfuels industry, but also to coal-fired utilities, coal conversion, slurry pipelines and coal transportation. The success of synfuel development from coal hinges on proving and improving certain technologies. Coal-fired utilities are experimenting with coal mixtures for fuel, with dry cooling technologies, and with the transportation of lignite fuel sources. Converting from an oil or gas-fueled boiler to a coal fueled boiler is currently only possible if the boiler was originally designed for coal. If these boilers are to convert, without merely replacing entire boilers, then bottom ash and heat transfer problems will have to be solved. Coal slurry pipelines are investigating the use of air, methanol, and CO_2 instead of water. New techniques are being tested to increase the distance for transmitting electricity by wire. European underground mining technologies are also being considered in Colorado. New longwall techniques and multi-bench mining, if allowed under safety regulations, would increase the recovery rate of underground coal mines.

While some of these technologies are affecting the present Colorado coal markets (e.g., lignite use in Texas, W.R. Grace slurry pipeline proposal), these technologies will probably have a greater impact on coal markets in the future. The success of synfuel technologies could be one of the major determinants of future coal markets in Colorado; the technologies removing the problems of large water consumption will affect local utility markets and transportation rates for Colorado coal.

E. Coal Characteristics.

Coal characteristics are probably more important determinants of coal markets than coal prices. Before negotiating price, the consumer must find the appropriate coal for his use. Boilers are designed and built for specific coal characteristics. There is not a lot of flexibility. Proposed boilers may be designed for a particular coal because of its price at the time or because of specific needs. Much conversation today centers on new utility construction because new utilities are

considering a broad market for buying coal. However, existing utilities and industrial boilers do not have this flexibility. Models and production projections must take this into account.

Coal characteristics significantly impact Colorado coal markets today and will continue to do so in the future. Because the State has coking coal and high Btu, low sulfur, ash and moisture coal, Colorado currently produces for metallurgical, utility, and industrial markets. It is more competitive and compatible with Eastern and Midwestern high Btu high sulfur coals than Montana and Wyoming coals. It is often used for spot market contracts. It is often used as a blending coal, mixed with a major coal source for a consistent feed. It does very well with smaller contracts.

These highly valued coal characteristics will also encourage future coal markets. Japan has made it clear that it wants only high Btu, low sulfur coal. Existing boilers which need additional coal contracts due to coal mine closings, reserve depletion, or coal prices are more likely to want coal with Colorado's characteristics, or at least need Colorado coal as a blending coal. Colorado coal characteristics will probably not be worth its higher price for new utilities, except those proposed for Western Colorado. Colorado does not have the volume of lower quality subbituminous coal favored for coal gasification and liquefaction that North Dakota, Wyoming, and Montana have. Future coal synfuel markets will be affected by this.

F. Electrical Growth Rate.

The nation's electrical growth rate determines the need for new electrical utilities. As this growth rate had been seriously overestimated for the past decade, the ratio of new utilities proposed to new utilities under construction or completed is very high. Coal mine operators anticipated many more new utilities would be on line today than there are now. This is one reason for Western coal overcapacity and the soft market.

Nevertheless, even with an electrical growth rate of less than four percent, new coal-fired utilities are being built. The utility market for coal will, however, directly depend on the electrical growth rate. As electrical growth rates are highest in areas of larger populations, new utilities will most likely locate closer to the populations. This is not generally favorable to Colorado coal production. In Colorado, the growing population is on the Eastern Slope. Eastern Slope utilities are contracting for Wyoming coal. The new utility market for Colorado coal is primarily limited to the Western Slope. The growth of this market depends upon the rate of energy development in Colorado - both for the electrical demand of the residential sector and of the industrial sector (i.e., energy development). Again, future Colorado coal markets depend heavily on synfuel production.

G. Productivity, Trained Miners, Labor Unions.

Colorado coal production can only expand if trained miners and

mining supervisors can be hired. Presently, there is not a shortage of these personnel, but there has been a supply limited enough to raise concern for underground mining.

Those mining personnel that are licensed, however, may not be the most appropriate for the job. There have been complaints that it is easier to train new underground miners than to retrain miners who have worked in Eastern mines. (The skills required to mine surface mines are easily learned and less specialized.) In the future, Colorado's underground coal production could be affected by a shortage of qualified miners, creating operational delays or lower productivity.

Productivity is higher in Western underground coal mines, including Colorado, than Eastern underground mines. However, this economic advantage will probably not affect Colorado coal markets. More important is the consistency of operation. Because many Colorado mines are not unionized and because even the union mines have good management-labor cooperation, some consumers are showing a preference for Colorado coal. This was particularly true in 1978 at the time of the major national coal strike. This strike increased Colorado spot market sales. If the UAW again loses influence over wildcat strikes, the non-union aspect of some Colorado coals could favorably affect their markets.

III. PROJECTED STATE PRODUCTION BY REGION AND FIELD
(see Figure 3 and Table 8)

A. Canon City Region and Field (bituminous)

The Canon City region and field is the smallest coal region in Colorado, covering only about 50 square miles. There are currently five mines producing approximately 165,000 TPY for nearby steam-electric power plants, State institutions, and local domestic purchases.

Four mines have closed or gone idle in this field since 1975. No new mines are proposed. One existing mine, which started production in 1979, is anticipating production of one MTPY by 1986. Whether there will be markets for the planned capacity is very uncertain at this time. If so, production in this field by 1991 could reach 1,680,000 TPY.

Future production in this field depends upon Texan or South Central markets and, to some extent, upon the success of the proposed coal slurry pipeline.

B. Denver Region (lignite and subbituminous)

This region covers 7,500 square miles of lower grade coals within 3,000 feet of the surface. The northern part of the region, the Boulder-Weld field, had several mines producing until 1979. There are no active mines now. The southern part of the region, the Colorado Springs field has not had producing mines for many years. It had been considered, however, for the Cameron Engineers synfuel plant near Watkins.

No new mines are proposed for this field. Weld County, however, has been designated by DOE as a likely site for synfuel development and synfuel proposals are possible. Future production depends upon the development of synthetic fuels.

C. Green River Region (subbituminous and bituminous)

Colorado encompasses just the Southeast arm of this coal region, called the Yampa field. This is the most productive field in the State. There are currently 11 mines producing almost ten MTPY. Current production goes primarily to utilities.

Six small mines have closed or gone idle, one large mine has closed, four large mines are near depletion of their reserves, and several large mines have recently lost significant contracts. There are 11 mines proposed for this region. Production in this region is expected to increase to 11.5 MTPY in 1986 and drop to 8.7 MTPY in 1991.

This is the field with the greatest market uncertainties. Future production depends upon Clean Air Standards, rail rates, and other market factors directly affecting utility fuels. It is the type of coal with the stiffest competition from Wyoming and Montana.

FIGURE 3

COAL REGIONS AND FIELDS IN COLORADO

COAL REGIONS

I	Canon City (field)
II	Denver Basin
III	Green River
IV	North Park
V	Raton Mesa
VI	San Juan River
VII	South Park (field)
VIII	Uinta

COAL FIELDS

1. Yampa
2. Book Cliffs
3. Grand Mesa
4. Somerset
5. Crested Butte
6. Carbondale
7. Grand Hogback
8. Danforth Hills
9. Lower White River
10. Durango
11. Walsenburg
12. Trinidad
13. Boulder-Weld
14. Colorado Springs
15. Canon City
16. North Park
17. Middle Park
18. South Park
19. Pagosa Springs
20. Nucla-Naturita

Source: Colorado Coal Directory and Sourcebook, 1978

TABLE 8

COLORADO COAL PRODUCTION PROJECTIONS BY FIELD
(in tons)

	1986	1992
Canon City Region		
Canon City Field	1,180,000	1,680,000
Denver Region		
Boulder-Weld Field	-	-
Colorado Springs Field	-	-
Green River Region		
Yampa Field	11,500,000	8,750,000
North Park Region		
North Park Field	100,000	100,000
Middle Park Field	-	-
Raton Mesa Region		
Walsenburg Field	50,000	50,000
Trinidad Field	883,000	933,000
San Juan River Region		
Durango Field	101,000	100,000
Nucla Field	130,000	130,000
Pagosa Springs Field	80,000	80,000
Tongue Mesa Field	-	-
South Park Region		
South Park Field	-	-
Uinta Region		
Book Cliffs Field	2,250,000	2,250,000
Carbondale Field	870,000	870,000
Crested Butte Field	200	-
Danforth Hills Field	4,200,000	4,200,000
Grand Hogback Field	-	-
Grand Mesa Field	110,000	110,000
Somerset Field	3,140,000	5,740,000
TOTAL:	24,594,200	25,993,000

D. North Park Region (subbituminous)

Because of the lower quality coal and faulted, lenticular, and folded coal beds, this region is not a major producer. The Middle Park field has never produced. The North Park field is the only part of this region where coal is presently being mined. There are two operating mines producing 785,000 TPY. One of these is temporarily idle and is rapidly depleting its reserves. These mines serve utility and industrial markets in Illinois as well as a Colorado molybdenum mine.

Production from this region is expected to drop to less than 100,000 TPY by 1991. Two new mines have been proposed since 1976, but there is no indication they will proceed. The Middle Park field has never, and probably will never, produce coal.

Future production depends upon the likelihood of in situ coal gasification in this region. The lack of nearby markets, however, will probably preclude this market option. Presently the coal is not competitive with Wyoming coal because of rail rates and more difficult mining situations.

E. Raton Mesa Region (bituminous)

There are two distinct fields within the Raton Mesa Region. The Walsenburg field has one mine producing almost 50,000 TPY. The Trinidad field has four mines producing almost 800,000 TPY, and three idle mines. The latter field produces coking coal for CF&I Steel and steam coal for Colorado utilities and State institutions.

Two mines have been proposed in the Walsenburg field and two mines in the Trinidad field. However, these proposals have existed for several years and potential markets are uncertain. Production is expected to remain stable in the Walsenburg field and increase in the Trinidad field due to mine expansion to 883,000 TPY in 1986 and 933,000 TPY in 1991.

Future markets depend in large part upon the markets for metallurgical coal or coking coal.

F. San Juan River Region (bituminous)

The larger part of this region lies in the State of New Mexico. There are, however, four fields within this region in Colorado. The Durango field has one mine producing 95,000 TPY. There are also two mines which produce sporadically, two mines currently idle and one proposed mine. This coal generally goes to domestic use and a tourist narrow gauge railroad. The Nucla field has one mine producing 122,000 TPY for a mine mouth utility, and two very small mines producing less than 500 TPY. The Pagosa Springs field has one small mine producing 79,000 TPY. The Tongue Mesa field has no active mines.

The production from this region is limited by geographic constraints and lack of railroad facilities. Production is not expected to change by 1991. Production is anticipated to be 310,000 TPY.

G. South Park Region or Field (subbituminous)

There is no active production and there are no proposed mines in this field.

H. Uinta Region (anthracite, semianthracite, bituminous)

One-half of the Uinta coal region lies in West Central Colorado, the other in Utah. There are eight fields within this productive region.

The Book Cliffs field has four mines producing 908,000 TPY, mostly for out-of-State utilities, and five idle or closed mines. The Carbondale field presently produces 842,000 TPY of high-quality coking coal from seven mines. This metallurgical coal is primarily used in Utah and California steel mills. The Crested Butte field has had one mine producing 270 TPY, but now has two idle mines. The Danforth Hills field has one mine increasing production to four MTPY which is shipped to utilities and industry, and two mines producing approximately 74,000 TPY. The Grand Hogback field has two mines which produced 600 TPY in 1979, but one is now closed. The Grand Mesa field has two mines producing 81,000 TPY. The Somerset field has five mines producing 2.4 MTPY. This coal is being shipped to utilities and CF&I Steel.

The Uinta Region has the greatest potential for attracting new non-synfuel coal markets. The coal in this region has the greatest likelihood of meeting the needs of Asian markets because of its high quality and the proximity to railroads. The greatest number of mines is proposed for this region. There are 11 proposed mines. Many leases are facing due diligence regulations. In addition, the only two proposed utilities for Colorado will most likely use Uinta coal - the Southwest Colorado Ute Plant and the Craig Unit 3 (which has contracted with coal in the Danforth Hills field of the Uinta Region, even though the plant will be in the Yampa field of the Green River Region). Uinta is also the region of the proposed coal-to-methanol project (Danforth Hills Field).

IV. APPENDICES

APPENDIX A

METHODOLOGY AND REFERENCES

The methodology used for these projections incorporates features and data from the following methods:

- o Macroeconomic models of national or regional coal markets.
- o Coal demand determined by signed contracts with utilities and industries.
- o Coal demand anticipated by existing and proposed coal-fired utilities.
- o Coal mine production capacities.
- o Scenarios.

For every inactive, idle, producing and proposed coal mine in Colorado, primary and secondary data were collected. Table 1 outlines all data sources. Table 2 outlines the types of data collected. The data were tabulated in a workbook, providing a comprehensive profile for each mine. Speculative, unreasonable, and contradictory data were discounted. Production projections were made for each mine based on its profile, judgements on the reliability of data sources, interviews with mine operators and general assumptions which follow.

TABLE 1

COLORADO COAL PRODUCTION PROJECTIONS: DATA SOURCES

1. Colorado Division of Mines

   - o annual production books
   - o monthly production sheets
   - o mine inspectors

2. Colorado Energy Research Institute

   - o "Coal Transportation in Colorado: An Analysis," 1979
   - o "Colorado Energy Production for the '80s", 1980

3. Colorado Geological Survey

   - o "Coal Directory and Source Book," 1978

4. Department of Natural Resources

   - o Projections for Mine Production in the Green River Area prepared for the Federal Regional Coal Team

5. Department of Energy

   - o "Annual Summary of Cost and Quality of Electric Utility Plant Fuels," 1977
   - o Documentation for Future Coal Units, Data Base File
   - o Western Coal Development Monitoring System, Quarterly Reports
   - o Coal and Electric Utilities Model - ICF
   - o "Federal Coal Leasing and 1985 and 1990 Regional Coal Production Forecasts"

6. Department of the Interior

   - o Regional Coal Production Forecasts - Office of the Secretary
   - o Coal Region Leasing Production Targets - BLM
   - o Coal Lease Applications - BLM
   - o Regional Coal Environmental Statements (EIS) - BLM
     - * Northwest
     - * Northwest Supplement
     - * West Central
   - o Site specific EIS's and EAR's on coal leases and mine plans - BLM
   - o Green River Potential Coal Lease Tracts Analyses - BLM
   - o Preference Right Lease Applications (PRLA) - BLM
   - o PRLA Processing Schedule - BLM
   - o Solictor's Opinions on PRLA's
   - o Mining and Reclamation Plans - OSM & USGS

7. Federal Power Commission

- "Proposed Generating Capacity Additions 1977-1986"

8. Colorado School of Mines, Mineral Economics Institute

- "Colorado Coal: A Production and Shipment Directory," 1977

9. National Coal Association

- "Study of New Mine Additions and Major Expansion Plans of the Coal Industry and the Potential for Future Coal Production," 1977
- "Steam Electric Plant Factors 1978,' 1978

10. Rocky Mountain Energy Company

- "Shortfalls in Federal Leasing Program: Green River-Hams Fork Coal Region"

11. Telephone interviews with every operating or proposed mine operator

TABLE 2

COLORADO COAL PRODUCTION PROJECTIONS:

DATA COLLECTED FOR INDIVIDUAL MINES

1. Current name, former names, and aliases
2. Current mine owner, former mine owners, and larger corporate affiliations
3. Type of coal and BTU quality
4. Rank of Coal
5. Type of mine and mining method
6. Union affiliation
7. Land/lease acreage and ownership
8. Adjacent land/lease ownership
9. Transportation mode and distance
10. Mine production schedule: start-up date, planned capacity, mine life
11. Historical production through December, 1979
12. Coal basin designation for DOI lease sales
13. Diligent development regulation requirements
14. Lease stipulations
15. Previous, current, and proposed contracts
16. Projected or estimated production

APPENDIX B

GENERAL ASSUMPTIONS

- The market for Colorado coal will remain weak through the late 1980's, affecting production through 1991. There will not be enough demand to purchase the amount of coal presently available from existing mines, currently proposed mines, federal lease sales, and Preference Right Lease Applications.

  This assumption is based on:

  * Present lack of firm long-term contracts for Colorado coal.

  * Substantial increase in coal rail rates for coal shipments and lack of evidence the federal government will do anything to reverse or postpone such rate increases.

  * Federal decision to continue operation of existing and under-construction nuclear power plants.

  * EPA new source performance standards which favor Eastern and Midwestern coal.

  * Competition from Wyoming and Montana coal in Midwestern, South Central, Northwestern, Western, and Colorado Front Range markets. (New Eastern Colorado utilities are contracting for Wyoming coal).

  * Competition from Utah coal in Southwestern and Western markets.

  * Competition from foreign coal in Southwestern, South Central, and Western markets.

  * Competition from lignite coal in the South Central states for the South Central market (one Colorado contract with a Texas utility has already been cancelled).

  * Large increases in natural gas supplies which are postponing the conversion of oil and gas boilers to coal in the South Central states.

  * Lack of new conversion by industry to coal as most of the Colorado industries using natural gas converted to coal in the early 1970s (during the shortage of natural gas supplies).

  * Demand for metallurgical coal may decrease because of the possible closing of some Western steel plants.

- A mine must have been proposed by 1980 to produce by 1986. Based on industry experience, there must be between six and eight years' lead time for a mine to produce, and an additional one to two years for its full production. There is also too much over capacity in existing mines.

- There will be no radical changes by any Energy Mobilization Board or a new Administration in 1981.

- Federal coal leasing will proceed on schedule and according to final regulations. This includes the current position within the U.S. Department of the Interior that no tracts within Colorado will be delineated for the Uinta or San Juan Coal Basin sales in 1981 and 1983, respectively.

- Federal coal lease tracts in the Green River - Hams Fork Region sold during the January 1981 lease sale could be in production by 1991. However, many tracts identified for this sale are contiguous to existing operations. It is assumed that most production from these tracts would be the continuation of an existing operation under existing contracts, rather than new production with new contracts. Any tract in this region developed as a new operation would require a lead time of several years. Tract ownership will be uncertain until all competitive bids are reviewed and analyzed by the Attorney General. Based on these conditions, it is assumed that any new operation on a 1981 lease tract in this region will not be in full production before 1991.

- No federal Preference Right Lease Applications (PRLAs), unless adjacent to existing leases or private land, will be in production by 1991 unless they are contiguous to a current operation. PRLA determinations will be made close to the final legal processing date of December 1, 1984. Some reasons for this assumption are: the Department of the Interior Solicitor's decision requiring most PRLAs to be adjudicated, the austere funding authorized by OMB to process the PRLAs, and the weak market for Colorado coal. Again, the six to eight year lead time would be a constraint on production.

- Federal diligent development regulations may cause several mines to produce before securing firm contracts.

- There will be no coal synthetic fuel plant using Colorado coal by 1991. Federal subsidies will most likely go to other states first (because of feasibility, market, and support for the oil shale industry in Colorado). However, it is assumed that limited oil shale production will take place by 1990, requiring additional electrical capacity from a coal-fired power plant.

APPENDIX C

TABLE OF COLORADO MINES

Producing Mines

County	Mine	Field	Status
Archuleta	Martinez	Pagosa Springs	
Delta	Blue Ribbon	Somerset	
Delta	King	Somerset	idle
Delta	Orchard Valley	Somerset	
Delta	Red Canyon	Grand Mesa	
Delta	Tomahawk	Grand Mesa	
El Paso	Bacon	Colorado Springs	closed
Fremont	Dorchester #1	Canon City	
Fremont	Cedar Canon	Canon City	idle
Fremont	Corley & Auger	Canon City	closed
Fremont	GEC	Canon City	
Fremont	Golden Quality	Canon City	inactive
Fremont	Hastings	Canon City	idle
Fremont	Newlin Creek	Canon City	
Fremont	Twin Pines	Canon City	
Garfield	East Salt Creek	Book Cliffs	failed
Garfield	Eastside	?	idle
Garfield	McClane	Book Cliffs	
Garfield	Munger	Book Cliffs	idl
Garfield	Nugap	Grand Hogback	closed
Garfield	Spink Canon	?	failed
Garfield	Sunlight	Grand Hogback	
Gunnison	Bear	Somerset	
Gunnison	Hawks Nest East	Somerset	
Gunnison	Hawks Nest West	Somerset	closed
Gunnison	O.C. Mine	Crested Butte	idle
Gunnison	Peanut	Crested Butte	idle
Gunnison	Somerset	Somerset	
Huerfano	Viking	Walsenburg	
Jackson	Canadian	North Park	idle
Jackson	Kerr-Marr	North Park	
La Plata	Blue Flame	Durango	idle
La Plata	Coal Gulch	Durango	idle
La Plata	Hay Gulch	Durango	idle
La Plata	King	Durango	
La Plata	Peacock #2	Durango	idle
Las Animas	Allen	Trinidad	
Las Animas	Baldy Canyon	Trinidad	idle
Las Animas	Delaqua 1	Trinidad	idle
Las Animas	Delaqua 2	Trinidad	
Las Animas	Healy Strip	Trinidad	idle
Las Animas	Helen	Trinidad	
Las Animas	Maywell	Trinidad	
Las Animas	Trinidad	Trinidad	failed
Mesa	Cameo	Book Cliffs	
Mesa	Farmers	Book Cliffs	closed
Mesa	Fruita 1	Book Cliffs	idle
Mesa	Fruita 2	Book Cliffs	
Mesa	McGinley	Book Cliffs	closed

Producing Mines (continued)

County	Mine	Field	Status
Mesa	Roadside	Book Cliffs	
Moffat	Colowyo	Danforth Hills	
Moffat	Eagle 5	Yampa	
Moffat	Eagle 9	Yampa	
Moffat	Trappers	Yampa	
Moffat	Williams Fork	Yampa	closed
Montrose	Nucla	Nucla-Naturita	
Pitkin	Bear Creek	Carbondale	
Pitkin	Coal Basin	Carbondale	
Pitkin	Dutch Creek 1	Carbondale	
Pitkin	Dutch Creek 2	Carbondale	
Pitkin	L.S. Wood	Carbondale	
Pitkin	Thompson Creek 1	Carbondale	
Pitkin	Thompson Creek 3	Carbondale	idle
Rio Blanco	Northern	Danforth Hills	
Rio Blanco	Rienau	Danforth Hills	
Routt	Apex	Yampa	idle
Routt	Blazer	Yampa	idle
Routt	Denton	Yampa	closed
Routt	Edna	Yampa	
Routt	Energy 1	Yampa	
Routt	Energy 2	Yampa	
Routt	Energy 3	Yampa	
Routt	Grassy Creek	Yampa	
Routt	Hayden Gulch	Yampa	
Routt	Johnny	Yampa	idle
Routt	K-400	Yampa	idle
Routt	Meadows Strip	Yampa	
Routt	Middle Creek	Yampa	closed
Routt	Seneca	Yampa	
San Miguel	Elder	Nucla	closed
San Miguel	Mad Jack	Nucla	idle
Weld	Eagle	Boulder-Weld	closed
Weld	Lincoln	Boulder-Weld	closed

Proposed Mines

County	Mine	Field
Delta	Fairview	Somerset
Delta	Farmers	Somerset
Garfield	Loma	Book Cliffs
Gunnison	Mt. Gunnison	Somerset
Gunnison	Windjammer	Somerset
Huerfano	Cullen	Walsenberg
Huerfano	No Name	Walsenberg
Jackson	Grizzly Creek	North Park
Jackson	Unamed	North Park
Jackson	Kemmerer	North Park
La Plata	Shalako	Durango
Las Animas	Lorencito	Trinidad
Las Animas	Mobil	Trinidad
Mesa	Anchor-Tresnor	Book Cliffs
Mesa	Coal Canyon	Book Cliffs
Mesa	Cottonwood Creek	Book Cliffs

Proposed Mines (continued)

County	Mine	Field
Moffat	Eagle 6	Yampa
Moffat	Eagle 7	Yampa
Moffat	Sugarloaf	Yampa
Rio Blanco	Gordon	Lower White River
Routt	Amca	Yampa
Routt	Dawson Unit	Yampa
Routt	Edna Test	Yampa
Routt	Joe's	Yampa
Routt	Moffat	Yampa
Routt	Sun	Yampa
Routt	Trout Creek (Massey)	Yampa
Routt	Trout Creek (P&M)	Yampa